DEVELOPMENT OF AN EVALUATION METHOD TO ASSESS PROSPECTIVE PHYSICIANS' COMPETENCE AND INTENT TO PRACTICE DIABETES NUTRITION THERAPY

By

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In Memory of

Norman Jack Lebow

June 9, 1936 - March 13, 1998

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"It is important of course to count and measure what is countable and measurable, but the most precious values in human life are aspirations which laboratory experiences cannot yet reproduce."

Rene Dubos, Mirage of Health (1959)

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KEY TO ABBREVIATIONS

AAMC	Association for American Medical Colleges
[1]ADA	American Dietetic Association
AMSA	American Medical Student Association
BG	Blood Glucose
CDC	Centers for Disease Control and Prevention
COD	Cause of Death
C-SAQ	Computer Self-Administered Questionnaire
CVD	Cardiovascular Disease
DCCT	Diabetes Control and Complications Trial
D-MNT	Diabetes Medical Nutrition Therapy
DHHS	U.S. Department of Health and Human Services
G-MNT	General Medical Nutrition Therapy
GPEP	General Professional Education of the Physician report
HbA_{1c}	Glycosylated Hemoglobin
HTN	Hypertension
IPNEC	Intersociety Professional Nutrition Education Consortium
IRB	Institutional Review Board
IRT	Item Response Theory
MNQ-D	Medical Nutrition Questionnaire for Diabetes
MNT	Medical Nutrition Therapy
PCP	Primary Care Physicians
PHS	Public Health Service
Pt	Patient
RSM	Rating Scale Method of Analysis
SAQ	Self-administered questionnaire
TRA	Theory of Reasoned Action
HSC	Health Science Center
UKPS	United Kingdom Prospective Diabetes Study

[1] American Diabetes Association will not be abbreviated.

Abstract of Dissertation Presented to the Graduate School
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DEVELOPMENT OF AN EVALUATION METHOD TO ASSESS PROSPECTIVE PHYSICIANS' COMPETENCE AND INTENT TO PRACTICE DIABETES NUTRITION THERAPY

By

Jessica Ann Schulman

August 2000

Chairperson: Barbara A. Rienzo, Ph.D.
Major Department: Health Science Education

The importance of nutrition education in medicine has been established in scientific literature. However, physicians have not been consistently trained to apply nutrition knowledge in practice. This study was undertaken to develop a method for measuring affective and cognitive aspects of nutrition competence among prospective physicians. The purpose was to construct a theoretically driven, valid and reliable instrument for assessing prospective physicians' self-efficacy, attitude, and knowledge of diabetes medical nutrition therapy (D-MNT). The survey involved three phases: (I) administration of a traditional self-administered questionnaire, (II) administration of a computer self-administered questionnaire (C-SAQ), and (III) data collection and analysis. Data were collected from 66 (56.4%) first- and 67 (57.2%) fourth-year medical students

who comprised a sample (N=234) that was self-selected from the University of Florida College of Medicine.

A valid instrument was developed for assessing prospective physicians' competence to provide D-MNT. This was accomplished by providing evidence that supports six major aspects of validity. Classic test theory (e.g. factor analysis, t-test, and correlations), and item response theory (e.g., rating scale analysis) were used to evaluate utility of the instrument. Most of the findings suggested that the instrument measured characteristics it was interpreted to assess. However, not every hypothesis that supports convergence, the external aspect of validity, was found. Reasons for this are described.

Results from this study could be used to assess nutrition competence among physicians and compel medical educators and policymakers toward remedial action. However, questions remain about the potential impact that nutrition in medical education may have on the health of the public. Thus, future evaluation studies are recommended and goals for nutrition education are suggested.

The study also provides an overview of contextual factors that influence nutrition literacy among physicians and explores relative levels of nutrition competence among prospective physicians at one college of medicine. On the basis of the results, it is recommended that teaching and evaluation of nutrition in medical schools as it relates to MNT must be strengthened. Findings may be generalized to similar U.S. accredited colleges of medicine and should prove useful in future evaluations of other populations with similar curriculum characteristics.

CHAPTER 1
INTRODUCTION

In a paper presented before the American Public Health Association, Robert E. Shank, physician and professor of preventive medicine emphasized the importance of nutrition education for physicians and a rationale for evaluating their nutrition competence:

> Physicians in practice assume a large share of the responsibility of guiding individuals to diets adapted to meet the needs of health or to treat disease. . . failure of any effort to utilize nutritional information or dietary manipulation to improve health rises or falls with the awareness and cooperation of the medical community. It is, therefore, of particular pertinence to ask, "How adequately are physicians trained and informed in nutrition?" (Shank, 1966, pp. 929-930)

The importance of nutrition education in medical practice is well established (Council on Foods and Nutrition, 1963; Davis, 1994; Feldman, 1995; Frankle, 1976a; Maillet & Young, 1998; Rombeau, 1984; Shank, 1966; Winick, Lowell, & Shulman, 1984; Young, 1992). Today, diet is associated with 5 of the 10 leading causes of death, such as coronary heart disease and type 2 diabetes (Bidlack, 1996). Moreover, approximately 200 billion dollars--or thirty-percent of national health care expenditures--are related to inappropriate diet (Bidlack, 1996).

Type 2 diabetes, formerly known as non-insulin dependent diabetes mellitus, is a chronic disease with an increasing incidence, high cost of treatment, and severe consequences due to non-adherence. In 1992, indirect (e.g. disability, work loss, premature death) and direct annual costs for diabetes were $98.2 billion (U.S.

Department of Health and Human Services [DHHS], 1998a). By 1995, diabetes was the number one cause of amputation, blindness, and end-stage renal disease (ESRD), and the seventh leading cause of death (COD) listed on U.S. death certificates (National Diabetes Data Group, 1997). With the prevalence of diabetes approaching six percent of the U.S. population and 798,000 new cases being reported annually (U.S. Department of Health and Human Services, 1998a), target objectives for diabetes as stated in Healthy People 2000 will not be achieved (Davis, 1994; U.S. Public Health Service, 1995). Diabetes is expected to emerge as a preeminent public health problem in the year 2000.

Despite pharmacological advances in diabetes treatment, medical nutrition therapy (MNT) continues to be an essential component of type 2 diabetes management (American Dietetic Association [ADA], 1999; Nair, 1999; Spollett, 1997). Comprehensive treatment of type 2 diabetes patients improves quality of life and is cost effective (Eastman et al., 1997). Similarly, medical insurance coverage of MNT can reduce health services utilization and expenditures. In persons aged 55 years and older, savings in the use of medical services has been shown to exceed the cost of providing MNT (Sheils, Rubin, & Stapleton, 1999). Practical approaches to dietary management culminated in the 1999 American Diabetes Association nutrition guidelines for people with diabetes (American Diabetes Association, 1999). Primary care physicians can play a pivotal role in promoting diabetes management by providing nutrition information, referring patients to qualified nutrition experts, realizing psychosocial or cultural issues, and facilitating lifestyle change (ADA, 1994; Hiddink, Hautvast, van Woerkum, Fieren, & van 't Hof, 1997; Lazarus, 1997; Ockene et al., 1995; Travis, 1997; van Weel, 1997). However, many physicians do not have basic nutrition skills necessary to screen,

monitor, or provide follow-up to patients suffering from diabetes--or patients at risk of developing the disease (Glanz & Gilboy, 1992; Lawler & Viviani, 1997).

Federal strategies to encourage and promote sufficient nutrition education for medical students and residents have not been achieved (American Medical Student Association, 1996; Frankle, 1976a; Glanz & Gilboy, 1992; Shils, 1990). With exception of a few medical programs (Hark, 1997; Rollins et al., 1999; Wilkes, Usatine, Slavin, & Hoffman, 1998), adequacy of nutrition training among medical students continues to be inconsistent, optional, and poorly examined (American Medical Student Association, 1996; Halsted, 1998; Shils, 1994; Winick, 1993; Young, 1997; Zimmermann & Kretchmer, 1993). As Shils (1994) summarizes, the criteria to assess nutrition competence--commonly used by the Association of American Medical Colleges (AAMC)--are relatively useless because they give no information about how well clinical nutrition has entered into the knowledge base of the graduating student (Shils, 1994, p. 631).

In a panel discussion of evaluation of nutrition education in the medical curricula, physician Robert Karp, presented one reason why nutrition competence among medical students and physicians has been poorly studied:

> Evaluation is time-consuming; it leads to friction, it leads to people calling up and wondering what you are doing…It leads to a lot of defensiveness--not in a necessarily bad way, but people don't really like to change. I urge you to do this [evaluation of nutrition education] in your own way, in your own institution; take the plunge, and do it now! (Shils, Karp, Stevenson, Kuperman, & Gebhardt, 1984, p. 601).

Today, criteria typically used for evaluating the state of nutrition education in U.S. medical schools include the number of schools with mandatory or elective nutrition courses (Karp, 1984; Shils, 1994; Wen, Weerasinghe, & Dwyer, 1973). There continues

to be scant research that use methods that assess the quality of nutrition education that prospective physicians obtain, or that measure associated patient outcomes. For example, a few studies have looked at the effect of nutrition education on affective attributes such as attitudes and self-efficacy among physician populations (Glanz & Gilboy, 1992). However, most generalizable evaluations of nutrition education rely on observable behavior or cognitive tests (Cohen, Hunsley, Wattler, Karsten, & Olson, 1981; Feldman, 1991; Hark et al., 1997; Morgan et al., 1988; Parker, Emmett, & Heaton, 1992; Phillips, 1971; Weinsier, Boker, Feldman, Read, & Brooks, 1986), while overlooking other theoretical constructs that have been demonstrated to predict health and practice behavior (Andersen, 1995; Bandura, 1982; Kushner, 1995; Raven & Litman-Adizes, 1988; Rosenstock, 1974a). Moreover, valid, reliable, and easy-to-use instruments that assess multiple dimensions of diabetes nutrition competence among prospective physicians are not available in literature.

Purpose of the Study

This study was undertaken to create an instrument that measures affective and cognitive aspects of nutrition competence among prospective physicians. The purpose was to construct a theoretically driven, valid and reliable instrument for assessing prospective physicians' self-efficacy, attitude, and knowledge of medical nutrition therapy (MNT) among diabetes patients. Goals were to: (1) describe the development of a nutrition education assessment tool, which will be referred to as the medical nutrition questionnaire for diabetes (MNQ-D), (2) discuss how social cognitive theory and behavioral models are applied in this study, (3) evaluate reliability and validity of the MNQ-D using classical test and item response theory, (4) describe how this tool can be

used for future outcomes research, and (5) begin to explore relative levels of nutrition self-efficacy, attitudes, and knowledge among graduating medical students at one conventional college of medicine.

In sum, this dissertation presents the context in which MNQ-D was conceived, describes theoretical bases for the study, and delineates each step that is required for examining construct validity. To enhance specificity, questions were, where appropriate, focused on MNT for nutrition management of diabetes. The validation study addressed prospective physicians': (a) perceived ability to perform MNT related tasks, (b) attitude toward nutrition education, (c) knowledge of MNT, and (d) intention to provide MNT. However, the primary focus of this project was to evaluate the validity and reliability of the assessment tool.

Hypotheses

Each of the hypotheses specified below addresses a single overarching research question: Is it feasible to construct a valid instrument for assessing prospective physicians' self-efficacy, attitude, and knowledge of medical nutrition therapy (MNT)? However, additional methods were used to examine evidence for construct validity (Chapter 3). Convergence, discrimination, and the external aspect of validity were appraised by analyzing relationships between factors (Chapter 4).

Predicted Relationships

1. Prospective physicians' perceived self-efficacy for providing MNT to diabetes patients is positively related to:
    a. prior nutrition education;
    b. adequacy of nutrition education in medical school;

c. intention to practice MNT.

2. Self-efficacy will not be associated with nutrition education that was a component of another medical school course.
3. Prospective physicians' attitudes about providing MNT will be positively associated with prior nutrition education.
4. There will be a positive relationship between current knowledge and prior nutrition education.
5. There will be a significant difference in prospective physician's perceived self-efficacy and knowledge about MNT over the course of medical school.
   a. self-efficacy among fourth year medical students will be significantly higher than first year medical students
   b. knowledge among fourth year medical students will be significantly higher than first year medical students

Group Differences

6. There will be no significant difference in medical students' attitudes toward nutrition therapy between first- and fourth-year students.
7. There will be no statistically significant difference between medical students' self-reported self-efficacy, attitudes, and knowledge when compared by gender
8. There will be no statistically significant difference between medical students' self-reported attitudes and self-efficacy when compared by age.
9. Adequacy of nutrition education will be low across first and fourth year medical.

Definition of Terms

Operational definitions of many terms used throughout this study include:

Attitude refers to the extent to which a student agrees/disagrees with affective statements toward diabetes MNT (Fishbein & Ajzen, 1975).

Competence refers to relative levels of nutrition self-efficacy, attitude, and knowledge.

Type 2 diabetes refers to a common chronic disease associated with devastating complications; blood glucose, weight, and dietary control can significantly reduce sequela (American Diabetes Association, 1999).

Diabetes patients are individuals that have been diagnosed with type 2 diabetes.

First year students are medical students within three months of completing their first year of school.

Fourth year students are medical students who are within 3 months of graduating from medical school (see definition for prospective physicians).

Intention to practice MNT is the percent of patients a prospective physician expects to provide MNT to over the next 12 months.

Knowledge is the total number of diabetes MNT related questions correct on a test.

Medical Nutrition Therapy (MNT) is a nutrition related practice behavior, such as screening, assessment, diagnosis, counseling, ordering a diet or consult, and providing diet related advise or instructions, to enable patients to achieve specific health goals (e.g. near-normal blood glucose and lipid levels, appropriate calories for maintaining reasonable weight, prevention and treatment of acute complications, and improvement of overall health through optimal nutrition) (ADA, 1999).

Medical school refers to any accredited medical school in the U.S.

Nutrition therapy is a general term for MNT.

Nutrition education includes any aspect of MNT that is taught in medical school.

Physician refers to a medical doctor who graduated from an U.S. accredited medical school.

Prior nutrition education refers to separate nutrition courses or hours taken before entering medical school (Winick, 1984).

Prospective physicians, graduating seniors, or fourth year students are medical students who are within 3 months of graduating from medical school.

Self-efficacy is a judgement by a student as to the extent to which they are confident in their ability to perform a specific task, in this case MNT (Bandura, 1982; Bandura, 1997).

Significance and Need for the Study

Reliable and valid survey instruments would allow researchers to identify factors that limit the ability of practitioners to provide MNT, and perhaps improve their understanding of nutrition behavior. In addition, applying information learned through scientific assessment techniques has potential to inform curricular decisions, assist health promotion and disease prevention efforts, improve the quality of life for people living with diabetes, and reduce health care costs. Valid instruments might enable medical educators to better assess educational needs of prospective physicians, their practices, and behavioral outcomes. In turn, more researchers would be able to study the long-term effects of nutrition competence among physicians and how this impacts the health of the public (Lazarus, 1997; Ockene et al., 1995).

Delimitations

The following delimitations or constraints should be considered when interpreting the study findings:

1. Participants were selected from an enrollment list of all first- and fourth-year medical students at the University of Florida, College of Medicine.
2. Data were collected during spring semester 1999 and 2000.
3. Medical students must have an e-mail account, and private access code provided by the College of Medicine.
4. Participants must have access to a computer and internet browser.
5. Medical students must have voluntarily agreed to participate in the study.
6. The researcher must have access to the colleges computerized evaluation system.

Limitations

The following limitations should be considered when interpreting the results of the study:

1. This particular collection of items for the questionnaire cannot be generalized to other aspects of nutrition self-efficacy, attitude, or knowledge. This instrument mainly relates to physicians' perceived ability to practice *diabetes* MNT with patients. Additional work will be needed to develop *general* measures of nutrition self-efficacy among physicians.
2. There was a small number of participating physicians from one particular site.
3. This study relies on the evaluation system of the particular medical school and requires support of key leaders in medical school administration.
4. Medical students were a relatively homogeneous group.

- In terms of demography, the majority of students are young adults that are White.
- Most respondents had very positive attitudes toward nutrition in medicine, which affected analyses that were performed. The rating scale method (RSM) of analysis is useful for assessing the validity of an instrument under development. For this study, however, RSM could only be used for the self-efficacy scale. Attitudes among physicians must be more diverse if RSM is applied.

Assumptions

1. This college was representative of most conventional medical schools in the U.S.
2. Students who participated during spring semesters of 1999 and 2000 were representative of all students enrolled at the college of medicine.
3. Students who voluntarily agreed to participate in the study were considered representative of all students enrolled the college of medicine.
4. The theoretical model and research design were appropriate for the purpose of the study
5. Participants had access to the computer and internet from home, campus, or their work setting
6. Variations in the participants' computer hardware and operating system software were not considered problematic in achieving the goals of the study.
7. The computer based self-administered questionnaire in phase II was an improvement over the previous paper and pencil method in phase I.

Summary

Chapter 1 presented the background of the study, the purpose of developing an instrument to measure nutrition competence, research hypotheses, definitions for key terms, the significance or need for the study, delimitations, limitations, and assumptions. Chapter 2 provides a review of relevant literature and contextual factors that justify this study. In addition, it discusses related research, describes a theory for examining construct validity, and proposes a theoretically driven model for predicting practice behavior.

CHAPTER 2
REVIEW OF LITERATURE

An overview of contextual factors that are increasing the need for physicians to be literate in nutrition is discussed in Chapter 2. This is followed by a summary of sociopolitical factors and the epidemiology of diabetes, which serves as a basis for justifying the need for evaluating physicians' nutrition competence.

Subsequently, the importance of diabetes medical nutrition therapy (D-MNT) is established, and patient self-management goals are provided. Next, a theoretical framework involving Bandura's Social Cognitive Theory (Bandura, 1982; Bandura, 1997), attitude theories (Fishbein & Ajzen, 1975; Millstein, 1996), and Green's conceptualization of the power educative approach, were applied (Green & Kreuter, 1991). In turn, a conceptual model to predict practice behavior is illustrated using three main factors: attitude, self-efficacy, and knowledge. A review of literature substantiates the importance of such variables when assessing nutrition competence of medical students and physicians. Finally, the research basis for development and validation of the MNQ-D is described.

Context and Background

> The void between theoretical knowledge and its translation to street-level reality is of substantial importance to use today. . . we have known for more than a quarter of a century that cigarette smoking is a major source of human morbidity. . . Yet it required a generation before there was significant public recognition of this hazard . . ." (Aronson, 1988, p. 9s).

Aronson's observations about smoking in the late 1980s are remarkably similar to what is occurring with dietary practices today. In the past, physicians missed opportunities to encourage smoking cessation to their patients. More recently, physicians have missed opportunities to provide nutrition information and counsel (Aronson, 1988; Bruer, Schmidt, & Davis, 1994; Frankle, 1976b). The 1985 National Health Interview Survey was conducted to investigate the extent to which physician contacts currently provide nutrition information. Persons surveyed were asked to rate the following question on a scale (often, sometimes, rarely, or never): "When you visit a doctor or other health professional for routine care, is eating proper food discussed?" (Stephenson, Levy, Sass, & McGarvey, 1987, p. 67). Twenty-nine percent of women and 22% of men reported that diet was discussed sometimes or often (Stephenson et al., 1987). As a result, a national nutrition objective was proposed, "By 1990, virtually all routine health contacts with health professionals should include some element of nutrition education and nutrition counseling" (Stephenson et al., 1987, p. 62).

At this writing, the national objective for nutrition education in the year 2000 was not achieved (Kuczmarski, Flegal, Campbell, & Johnson, 1994; DHHS, 1998b). This is unfortunate because the importance of nutrition in primary care medicine has been established. Myron Winick, M.D., points out that nutrition literacy is essential across multiple specialties:

> Internists must be able to prescribe special diets for patients . . .surgeons must be able to maintain good nutrition in their patients both before and after an operation. Obstetricians must be sure that both mother and fetus are adequately nourished during pregnancy. Pediatricians must be able to instruct mothers on how best to feed their infants. Psychiatrists are treating eating disorders such as obesity and anorexia nervosa. And the family practitioners are concerned with almost all of these problems (Winick, 1988, p. 12s).

In 1992, the percentages for physicians who developed a nutrition plan for at least 81-100 percent of patients with chronic disease were as follows: pediatricians— 31 percent; nurse practitioners—31 percent; obstetricians/gynecologists—19 percent; general internists—33 percent; family-California physicians—24 percent (DHHS, 1998b). These percentages are far below the 2000 target goal, which was 75 percent for each specialty.

Further research demonstrated a need for primary care physicians to understand the importance of dietary management and diabetes care (DHHS, 1998b). During the 51st annual scientific session of the American Association of Family Physicians, physician researchers presented a study that compared how well doctors comply with American Diabetes Association testing guidelines. Their findings were based on an analysis of insurance claims data from 5,541 diabetics living in three eastern states. It was reported that less than 19.8% ordered and interpreted glycosylated hemoglobin (HbA_{1c}) values. This laboratory test is essential for assessing blood glucose (or sugar) control over the past three months as well as adherence to nutrition protocols.

With a broadened disease prevention base and improved surveillance data systems, objectives for Healthy People 2010 have become particularly relevant to nutrition education among physicians and their patients. Again, new objectives (available on-line: http://www.health.gov/healthypeople/), corroborate that nutrition counseling or education services for diabetes and other chronic diseases must be improved. The 2010 target goal (75%) for diet counseling across physician practitioners continues to be far above baseline (42%) (DHHS, 2000, On-line). Only 3% of patients

received counseling during an office visit for weight reduction, which is a major risk factor for type 2 diabetes.

Sociopolitical Factors

Much of disease prevention in medicine has been shaped by social and political forces (Coe, Pepper, & Mattis, 1977; Martin & Howell, 1989; Mechanic, 1993). The establishment of preventive medicine as a discipline, for example, was fostered by recent concerns that medical care emphasizes cure, rather than care, and by efforts to reduce health care costs (Davis, 1994; Martin & Howell, 1989). Today, sociopolitical factors are having a profound influence on changes in medical curricula, moving medicine away from traditional biomedical curricula and toward more comprehensive programs of study that include prevention (Mennin & Krackov, 1998; Rollins et al., 1999; Shils, 1994). As a result, improvements in nutrition education can be addressed only in the broader context of how it is perceived and accepted by health professionals and society (Schulman, 1999). Moreover, the social context must be understood if researchers are to conduct valid assessments that are consequential in nature (Messick, 1981). The following subsections explore how sociopolitical factors are influencing the evolution of nutrition in medical schools and highlights the need for programmatic research in medical nutrition education, particularly diabetes self-management education.

Public demand for nutrition information

The public is becoming more nutrition conscious and demanding of reliable sources of nutrition information (ADA, 1994). This is a result of an increased emphasis on nutrition by the medical profession and a growing public awareness that physicians are not nutrition

experts. In addition, the public wants to get nutrition advice from their physicians and are subtly demanding that physicians be better trained (Winick, 1988).

Historically, physicians have not been prepared to assess and treat nutrition problems in their patients (Butterworth, 1974; Council on Scientific Affairs, 1990; Davis, 1994; Halsted, 1998; Maillet & Young, 1998; National Research Council, 1985; Shank, 1966; Weinsier et al., 1991; Winick, 1993). In addition, the public has been presented a negative image of the nutrition expertise among physicians by the press (Schollar, 1989). Suspicious attitudes toward physicians encourage people to seek nutrition information from sources that may be unreliable (ADA, 1994; Buttriss, 1997; Eisenberg & Kessler, 1993; McLaren, 1994). Winick points out that, "While many nutritionists and dietitians are well trained and professional, it is also true that no field is inundated with more self-styled experts and out-and-out quacks than the field of nutrition" (Winick, 1988, p. s13). Nutrition fraud and food faddism will continue to be rife as long as physicians are ignorant about nutrition and the public continues to seek dietary advice (McLaren, 1994).

There is consensus among physicians that nutrition is an essential aspect of health care (Lazarus, 1997). In a nationwide survey by Levine et al. (1993), researchers reported that 60% of physicians had positive-attitude statements toward nutrition (e.g., diet has an important role in the prevention of heart disease) and disagreed with negative-attitude statements (e.g., physicians are not well prepared to provide nutrition counseling) (Levine et al., 1993). The survey demonstrated that, in general, physicians do value nutrition education. However, physicians who valued nutrition did not have an appropriate knowledge base to counsel patients. This study, as well as others, demonstrates need for

nutrition education among all primary-care physicians (Kirby, Chauncey, & Jones, 1995; Levine et al., 1993; Young, 1983).

Inadequate nutrition training

> Many undesirable practices concerning the nutritional care of hospitalized patients have their roots in long-standing neglect of nutrition in medical education and in health care delivery systems (Butterworth, 1974, p. 8).

Neglect of and opposition to integrating nutrition education in medical curricula has become well documented. In 1987, the ADA issued a report which suggested educational opportunities in medical school were unrecognized or underused (ADA, 1987). This problem was highlighted by Aronson, (1988) who affirmed that there have been failures in achieving effective means of teaching nutrition precepts to medical students, who will play a primary role in teaching--or not teaching--the elements of diet and living to those that seek their counsel (Aronson, 1988, p. s9). Soon after, the National Academy of Sciences (NAS) established that nutrition education in medical schools was inadequate (ADA, 1994). The classical yardstick of time (Swanson, 1988), or number of courses, was used to assess nutrition in medical schools. Although nutrition courses have been recommended over the past thirty years, the NAS found a downward trend in the number of required courses offered.

The AAMC published data that indicates the current level of nutrition course offerings for all U.S. accredited medical schools. In the academic years 1991-1992 to 1998-1999, less than 30% of schools reported a *required nutrition* course (Association of American Medical Colleges [AAMC], 1991; AAMC, 1992; AAMC, 1993; AAMC, 1994; AAMC, 1995; AAMC, 1996; AAMC, 1997a; AAMC, 1998) (Figure 2.1). For years 1994-1995 to 1998-1999, about 50% of schools reported an *elective nutrition*

course. Percentages of required courses usually tend to be lower than those separately derived and reported by the Liaison Committee on Medical Education (LCME). However, some consider the LCME's numbers to be overstated (DHHS, 1993). Currently, there is no systematic method to measure quality and quantity of nutrition education provided within medical courses (DHHS, 1993).

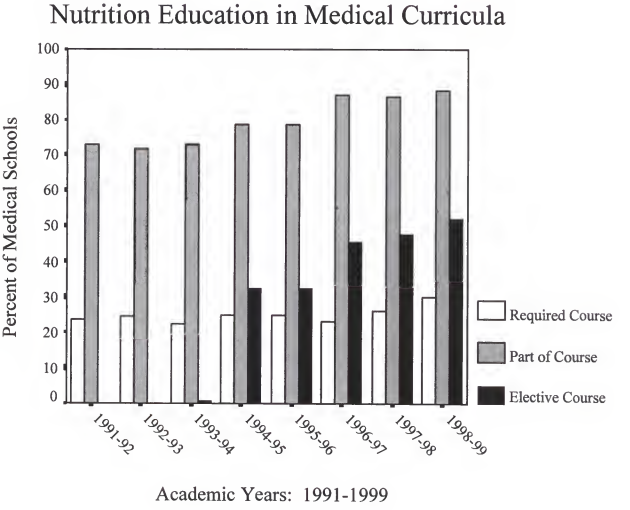


Figure 2.1. Percentage of U.S. accredited medical schools offering nutrition education. Response rate > 90% for all years (N = 128 in 1998). Annual figures are provided by the AAMC, Washington, D.C. (in Schulman, 1999).

Primary care physicians (PCP) must be prepared to treat a variety of lifestyle-related problems, such as diabetes and obesity, with nutrition advice (van Weel, 1997; Winick, 1993). In turn, a modest trend has developed toward increasing PCPs (Ginzberg, 1996) and giving more attention to how environmental factors influence health (Shils, 1994). Meyer (1997) found that most schools recognize the importance of revising their curricula to meet the managed care challenge, and that they were either developing or had programs to train students for practice in managed care environments. Though some critics still presume that reform initiatives have not successfully modified physicians' behaviors and attitudes (Hafferty, 1998), some progress evidently has been made (Matson, Ullian, & Boisaubin, 1999). At the latest AAMC Forum on the Future of Academic Medicine, Michael Whitcomb, MD dispelled the belief that medical schools cannot change their curricula (Iglehart, 1998). Twenty-four medical schools are working with the AAMC's Medical Schools Objectives Project (MSOP) on curricular reform, despite expanding conceptualizations of health that place more pressure on already stressed academic medical centers, their missions, and their curricula (Iglehart, 1998). In addition, Shils (1994) points out that the number of medical schools with a new form of instruction--problem-based learning (PBL)--has soared. In consideration of these changes, it may be an opportune time to integrate nutrition into medical training (Schulman, 1999).

Epidemiology of Diabetes

Diabetes has become one of the most common chronic diseases in the U.S. and is associated with various comorbidities and death (Harris et al., 1998). Public health surveillance data is used to illustrate the need for an effective response to managing type 2 diabetes (Centers for Disease Control and Prevention [CDC], 1997a; CDC, 1997b).

Prevalence and incidence data from the CDC were compiled from two main sources: (1) the National Health Interview Survey (NHIS), of the CDC's National Center for Health Statistics, which is an annual survey of approximately 120,000 U.S. residents and (2) the Behavioral Risk Factor Surveillance System (BRFSS), which is an ongoing, monthly, state-based telephone survey of the U.S. adult population (CDC, 1997a). The CDC notes that NHIS and BRFSS data underestimate the true prevalence of diabetes: "About half of persons with diabetes do not know they have it...proxy respondents (i.e., household members responding for absent adult members) are also likely to underreport diabetes" (CDC, 1997a, on-line). The described statistics provide important information that validates an urgent need for management of diabetes, cutting across special populations and high-risk groups. Diabetes and its related complications are a significant cause of morbidity and mortality internationally (CDC, 1997a).

Prevalence and Incidence

Type 2 diabetes accounts for about 90% to 95% of all diagnosed cases of diabetes (e.g., Type 1 diabetes, gestational, or other types resulting from medical or genetic conditions) (DHHS, 1998a). According to the CDC (1997), the number of persons with diagnosed diabetes increased 2.2 million (39%) between 1980 and 1994. Eight million persons in the U.S. (3.1% of the population) reported they had diabetes mellitus in 1994. Based on more recent 1997 census estimates, however, 15.7 million people (5.9% of the population) are thought to have diabetes (DHHS, 1998a); 10.3 million people have been diagnosed and 5.4 million people remain undiagnosed. Among older adults (> 65 years) 18.4% have diabetes, and among younger adults (20 to 65 years) 8.2% have diabetes (DHHS, 1998a).

In the 1990s the incidence of diabetes was estimated to be 748,000 per year (Centers for Disease Control and Prevention [CDC], 1997a). By 1994 new cases were 3.5 per 1,000 population or 49% higher than the incidence in 1980 (2.3 per 1,000 population) (CDC, 1997a). However, new estimates indicate that the incidence may be closer to 798,000 (DHHS, 1998a). The CDC points out that it is impossible to determine whether this increase in diabetes incidence is due to an increased actual number of new cases, increased diagnosis or ascertainment, or a combination of these factors (CDC, 1997a). What ever the case may be, diabetes is a complicated disease that requires multidisciplinary action and close surveillance.

By 2030, there will be an estimated 70 million older persons, which is more than twice their number in 1996 (Administration on Aging, 1997). Although new cases of diabetes are *not* occurring disproportionately in the elderly (CDC, 1997a), diabetes related complications are expected to become a more extensive problem as people bring the disease with them into older adulthood. Nearly every organ in the body is negatively impacted by diabetes. Persons with diabetes are at increased risk for stroke, ischemic heart disease, peripheral vascular disease, and neuropathy (CDC, 1997a). These problems are more evident if diabetes is not well managed with medication, nutrition, and exercise (Bidlack, 1996; Nair, 1999; The Diabetes Control and Complications Trial Research Group, 1996).

Mortality

Throughout the 1980s, the diabetes mortality rate remained relatively constant; however, in 1989 the diabetes death rate increased 14% and then continued to increase through the 1990s at 11%. By 1994, the age-adjusted diabetes death rate was 27% higher

than in 1980, and diabetes became the 7th leading COD in the U.S (DHHS, 1998a). Absolute levels of mortality from diabetes did not significantly increase in between 1980 to 1994; however, annual number of diabetes-*related* deaths (deaths for which diabetes was recorded as any cause) increased. For example, cardiovascular disease was listed as the underlying COD in close to half of all cases (CDC, 1997a).

Associated risk factors & special populations.

The burden of diabetes disproportionately affects minority populations and is likely to increase as minority and older populations increase. Additionally, the upward slope of new cases of overweight and obesity is having an impact on the magnitude and distribution of adult- and, more recently, juvenile-onset diabetes. In due course, diabetes poses an enormous public health challenge in America.

In 1994, prevalence of diabetes was higher for blacks than for whites across all age groups (CDC, 1997a). The CDC reports that, 11% of all non-Hispanic blacks have diabetes (DHHS, 1998a), and for the years 1980 to 1994, the largest increase in age-specific prevalence was observed in those aged < 45 years (CDC, 1997a). When leading CODs were examined by race, diabetes ranked as the 7th leading cause among blacks, Chinese, and Filipinos (CDC, 1997a).

Among four race-sex groups that the CDC examined (white and black males and females), black females had the highest absolute rates, but the greatest rate of increase was seen for black males (CDC, 1997a). These findings indicates that a large proportion of the disparity in mortality rates among the general population results from the greater prevalence of diabetes among blacks (CDC, 1997a). Overall, it is estimated that the same proportion of men and women have diabetes (8.2%) (DHHS, 1998a). However, diabetes

was the 4th leading COD among females who were black or of Hispanic origin in 1994 (DHHS, 1998a). Furthermore, black females had the highest rates of diabetes (CDC, 1997a).

There are effective treatments likely to improve the lives of people with diabetes, to reduce their long-term complications, and, in some cases, to prevent onset of diabetes. However, treatments for overweight and obesity are not being universally applied. (Clark, 1998, p. 475). Increasing Body Mass Index (BMI) or body weight carries an increased risks of diabetes (DHHS, 1998b), and since 1980, the prevalence of obesity in adults, and young children, has been increasing (Kuczmarski et al., 1994). Nationally representative data document a substantial increase in overweight in the public and are consistent with observations that there has been a marked increase in the prevalence of diagnosed and undiagnosed diabetes in the U.S. (Bidlack, 1996; DHHS, 1998b).

To examine trends in overweight prevalence, nationally representative cross-sectional surveys with an in-person interview and a medical examination were conducted. Between 6,000 and 13,000 individuals were assessed in each of four separate surveys: (1) the first National Health Examination Survey (NHES I), 1960 to 1962, (2) the first National Health and Nutrition Examination Survey (NHANES I), 1971 to 1974, (3) NHANES II, 1976 to 1980, and (4) NHANES III, 1988 to 1991. Results from NHANES III, phase 1 indicate that 33.4% of US adults were overweight (Kuczmarski et al., 1994). Comparisons to previous overweight prevalence surveys indicate dramatic increases in all race/sex groups. For example, overweight prevalence increased 8% between the 1976 to 1980 and 1988 to 1991 surveys; mean body weight increased by 8 lbs (Kuczmarski et al.,

1994). For the young and old, weight will increase the likelihood of human suffering and the burden of diabetes on the U.S. population.

Diabetes is a costly disease in terms of decreasing individuals' quality of life and the economic burden it imposes on society (Brown, Nichols, Glauber, & Bakst, 1999; CDC, 1997a). The CDC estimates that over one-third of persons suffering with diabetes report being limited in a major activity, such as eating (CDC, 1997a). In addition, indirect and direct costs for diabetes were $98 billion. Indirect costs associated with productivity (e.g., disability, work loss, premature mortality) are about $54 billion, and direct medical expenditures are about $44 billion (DHHS, 1998a). Many of these costs are related to inpatient, outpatient, and emergency medical services. For example, diabetes was recently listed as 1 of 7 diagnoses upon discharge (CDC, 1997a) and about 1 in 10 persons with diabetes had a related emergency room visit (DHHS, 1998a). It is notable that the highest rate of emergency visits were among persons aged < 45--having more than twice the rate of the older adult groups (DHHS, 1998a). If diabetes is not well managed disability and dependence on the medical care system will ensue.

Diabetes and Medical Nutrition Therapy

Type 2 diabetes is a chronic metabolic disorder characterized by insulin resistance, or relative (rather than absolute) insulin deficiency (The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1998). Most people with this form of diabetes are obese, and being overweight alone causes some degree of insulin resistance. In turn, hyperglycemia occurs because the body's ability to remove glucose from the blood to the cells becomes impaired. Diagnosis of diabetes is warranted if one instance of symptoms with casual plasma glucose is ≥ 200 mg/dl, confirmed by a

subsequent fasting plasma glucose of ≥ 126 mg/dl (The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 1998). If BG is not well controlled, long-term damage, dysfunction, and multi-system organ failure (e.g., eyes, kidneys, nerves, heart, and blood vessels) may ensue. This is supported by evidence from the San Antonio Heart Study in which 4,875 subjects were followed for 7-8 years (Wei, Gaskill, Haffner, & Stern, 1998).

Diabetes is usually treated in a primary care setting by medical care providers who may prescribe oral glucose-lowering medications, and in some cases, insulin. The objective is to achieve near-normal glycemia (blood glucose level), however, many of the prescribed agents induce weight gain--further aggravating insulin resistance. Diet combined with exercise, on the other hand, resulted in increased insulin sensitivity, and decreased need for medication. For these reasons, the cornerstone of diabetes management is still MNT, despite recent advances in the pharmacological treatment of diabetes (Spollett, 1997). The American Diabetes Association emphasized the importance of diet, "Medical Nutrition Therapy (MNT) is integral to total diabetes care and management...[and] nutrition therapy is an essential component of successful diabetes management" (American Diabetes Association, 1999). This is not to say that MNT is the best method of controlling diabetes; when pharmacological and nutrition therapies are combined medical outcomes are better than when either method is used alone (monotherapy) (Lipkin, 1999; Nair, 1999). In addition, coverage of MNT can result in a net reduction in health services utilization and costs for some populations (Franz et al., 1995a; Franz et al., 1995b; Sheils, Rubin, & Stapleton, 1999).

Advances in Diabetes and Nutrition Research

Results from the Diabetes Control and Complications Trial (DCCT) demonstrated that vigilant BG control, coupled with appropriate daily insulin injections substantially reduced onset and progression of microvascular complications, such as retinopathy and nephropathy, in persons with type 1 diabetes--characterized by the inability to synthesize insulin (The Diabetes Control and Complications Trial Research Group, 1996). However, there was concern that this may, or may not, apply to persons with type 2 diabetes--characterized by ineffective use of insulin. Therefore, The United Kingdom Prospective Diabetes Study (UKPDS) was conducted to address this issue, and results are now available (Nair, 1999).

Nearly 5100 patients were examined and followed for an average of ten years. During the first phase of the UKPDS, all diabetes patients underwent intensive diet therapy, resulting in a 2%-point decrease in HbA_{1c}. This was followed by intensive pharmacological therapy, resulting in a further significant drop in HbA_{1c}. Researchers found that monotherapy (e.g., diet only) failed to achieve glycemic targets. However, patients who used multiple methods were able to achieve long-term glycemic control, as reflected by HbA_{1c}, and this was associated with a decrease in microvascular complications by 25% (Nair, 1999). An epidemiological analysis of the data indicated that every percentage point decrease in HbA_{1c}, was associated with a 35% reduction in the risk of complications, and that every percentage decrease in HbA_{1c} was associated with a 25% reduction in diabetes-related deaths (Nair, 1999). The UKPDS affirms that achievement of tight BG control in type 2 diabetes, in addition to type 1 diabetes, is feasible and that diet remains an important adjunct to pharmacological therapy (Nair, 1999).

Nutrition Recommendations and Principles

During the 1880s, diabetes was considered to be a defect in the body's utilization of food stuff, and in turn, carbohydrates were withdrawn and dietary fat was used liberally (Laitinen, 1994). After the discovery of insulin in 1921, a wide diversity in the nutritional management of diabetes was extant (Laitinen, 1994). This included very low calorie diets, low protein diets, and severe restriction of simple carbohydrates, such as table sugar. There is no longer one single diabetic diet (Lipkin, 1999), but even with today's individualized approach, there is scientific agreement about what is considered an optimal diet for persons with type 2 diabetes. For example, in later versions of nutrition guidelines, a higher proportion of fat in the form of monounsaturated fatty acids are encouraged (American Diabetes Association, 1999; Franz et al., 1994; Laitinen, 1994).

Current goals for Goals of MNT are to: (1) maintain near-normal BG, by balancing food consumption with insulin or oral hypoglycemic agents, (2) achieve optimal serum lipid (e.g., triglyceride and cholesterol) levels, (3) obtain adequate calories for maintaining or attaining a reasonable weight, (4) prevent and treat acute complications of insulin-treated diabetes, such as hypoglycemia, and (5) improve overall health through optimal nutrition (American Diabetes Association, 1999; Lipkin, 1999). The American Diabetes Associations recommendations for the year 1999 provide a basic framework for educating patients in primary care settings. Specific guidelines for MNT are used for instrumentation and are provided in Appendix A.

Research Basis for Instrument Development

Theoretical constructs derived from Bandura's Social Cognitive Theory, which includes self-efficacy, alongside Green's power educative approach was used as a basis for developing the MNQ-D. In addition, previous nutrition education studies involving self-efficacy, attitudes, and knowledge, as they pertain to this study are described. Messick's notion of a unified concept of validity was applied during instrument construction, as well as the validation phase of this study.

Theoretical Framework

It is understood that nutrition education does not employ a single unified theoretical framework (Glanz, Lewis, & Rimer, 1997; Hochbaum, 1981). This is not to say that using one aspect, or part, of a theory justifies a claim to have used the entire theory itself (Hochbaum, 1992, p. 309). Accordingly, one major theory of behavior change and related concepts, or models, were used as a basis for developing an instrument that assesses nutrition competence among medical students.

A broad theory is necessary when measuring factors that predict physician practice behavior, because there are a plethora of social-psychological (Hiddink, Hautvast, van Woerkum, Fieren, & van 't Hof, 1995; Kushner, 1995; Shils, 1994; Young, 1992), and structural barriers (Ockene et al., 1996; Rosenstock, 1974b), that prevent physicians from providing dietary counseling. For this reason, Albert Bandura's multifaceted Social Cognitive Theory was used to evaluate and to predict nutrition-related practices among prospective physicians. Through deduction, expectations about nutrition competence were determined by studying presumed relationships between attitude, self-efficacy, and knowledge. Thus, a model is presented that illustrates the

relationship between these constructs and larger theoretical framework. Moreover, an ecological approach (McLeroy, Bibeau, Steckler, & Glanz, 1988; Steckler et al., 1995), and related aspects of social power, are used to justify the need for understanding nutrition-related practices through institutional change, namely medical schools. These broad conceptualizations supplement each other and were integrated to predict nutrition-related practices. In turn, this study employed a comprehensive approach to assessing cognitive and affective characteristics of nutrition competence. Particular variables were used together to form a framework, that assesses nutrition competence and predicts physicians' behavioral intentions.

Social cognitive theory

In Social Cognitive Theory, Bandura stipulates that behavior change is affected by environmental influences, personal factors, and attributes of the behavior itself (Bandura, 1997). However, sense of ability or *self-efficacy* is a key factor for understanding human behavior (Bandura, 1982; Bandura, 1997). Conceptual models that do not include perceived efficacy as a factor that influences people's ability to adopt and maintain a health behavior, sacrifice explanatory and predictive power (Bandura, 1997). Self-efficacy is described as self-confidence in one's ability to successfully perform a specific type of task or activity. Advantages of increased self-efficacy include higher motivation when barriers arise and a better chance that positive behaviors will persist over time outside a situation of formal supervision (Glanz & Rimer, September 1997). Physicians' practices are health related behaviors that can be measured with respect to this theory. Key physician factors associated with the provision of MNT include high self-efficacy (Engel, Crandall, Basch, Zybert, & Wylie Rosett, 1997; Glanz, Tziraki, Albright, &

Fernandes, 1995; Wheat, Killian, & Melnick, 1991) and a belief in the impact of diet and nutrition counseling on disease (Glanz et al., 1995; Kushner, 1995; Schucker et al., 1991).

For prospective physicians to provide quality nutrition counseling, or arrange for nutrition consultation, they need to know what treatments are effective for diabetic patients and when to intervene. Albert Bandura (1997) asserts, "What people need is knowledge about how to regulate their behavior and firm belief in personal efficacy to turn concerns into effective preventive actions" (Bandura, 1997, p. 280). As applicable as this is for an individual's, or the publics' health behavior, this concept is notably relevant when attempting to understand physician practice behavior. In consideration of Bandura's conceptual model of health behavior (Bandura, 1997, pp. 282-286), physicians will need to develop an understanding, or knowledge, of MNT. It is understood that knowledge creates the precondition for change, but additional influences are needed to overcome barriers to adopting new practices (Bandura, 1997). Thus, if new physicians are to initiate and adhere to D-MNT recommendations (American Diabetes Association, 1999), they also must possess self-confidence in their ability to counsel patients effectively without supervision, and across medical settings.

Attitude theory

Attitude has been described as the degree of positive or negative affect associated with a psychological object, such as a symbol, phrase, slogan, person, institution, or idea (Edwards, 1957). Research on attitudes has been guided by Fishbein-Ajzen's conceptual framework, the Theory of Reasoned Action (TRA) which distinguishes between beliefs, attitudes, intentions, and behavior, and has guided attitude research (Fishbein & Ajzen, 1975; Glanz et al., 1997). It is suggested that a belief is a probability judgement, or

heuristic device, that links an object or behavioral concept with some attribute. In turn, an amalgam of specific beliefs serve as an informational base, and ultimately drives an individual's attitudes, intentions, and behavior. In 1996, Millstein stated that theoretical models could be useful for examining physician behavior, but that no prospective studies conducted in the U.S. have been reported (Millstein, 1996, p. 398). New evidence regarding attitudes and nutrition related practice behavior is reviewed in the forthcoming chapter.

The national project entitled, "Physicians for the twenty-first century: Report of the project panel on the general professional education of the physician [GPEP] and college preparation for medicine", validates the idea that physicians-in-training need to develop practical skills and knowledge of basic nutrition, as well as specific *attitudes* toward its provision:

> Medical faculties should emphasize the acquisition and development of skills, values, and attitudes by students at least to the same extent that they do their acquisition of knowledge (Project Panel, 1984) in (Swanson, 1988, p. s14).

The AAMC the GPEP report to emphasize that medical competence is more than just acquisition of knowledge (Project Panel, 1984; Swanson, 1988). In light of this, a coherent nutrition education program is expected to include a component that enables physicians-in-training to develop positive attitudes toward MNT.

Bandura proposes that social changes often fail because they do not proceed beyond the precondition stage, which is aimed at informing people and altering their attitudes toward the innovations (Bandura, 1997). Government organizations have, in the past, failed to alter medical school administrators' attitudes toward the provision of MNT training. This has prohibited the establishment of comprehensive nutrition education

programs for prospective physicians, and, in turn, has thwarted behavior change. Research indicates that if practitioners have negative attitudes towards lifestyle change, such as adoption of a healthy diet, then their patients' adherence is expected to be poor (Arfken et al., 1997, p. 328).

A focus on attitude change assumes that attitudes determine behavior, however, there continues to be debate as to whether attitudes influence behavior or the reverse (Bandura, 1997; Andersen, 1995; Festinger, 1957; Rosenstock1974b). Appendix B indicates that attitude goes in both directions, attitude affects practice behavior and practice behavior affects attitude. Particular factors such as attitude and self-efficacy regulate human motivation and action (Bandura, 1997). As a result, they must be addressed in efforts to motivate people to adopt new social practices that improve the health of individuals, communities, and the public.

Power Educative Approach: Rationale & Conceptualization

Bandura warns that, "Shaping the social future through genuine institutional change is a long, tortuous process" (Bandura, 1997, p. 500). However, there are theoretical and pragmatic rationales that support use of a socioenvironmental approach. The Acting Assistant Secretary for Health chaired the third review of progress on Healthy People 2000 objectives for nutrition (DHHS, 1998b), and members concurred that, when setting agendas for research on changing dietary behavior, behavioral and social intervention strategies should be explored. This is consistent with the need for assessment of political, regulatory, and organizational factors (PRO) in health promotion, as emphasized by Green and Kreuter (Green & Kreuter, 1991).

Green and Kreuter (1991) describe that preferred means of bringing about social and organizational change is to educate leaders or strong forces in the community. The *power educative* approach identifies health professionals whose behavior is jeopardizing the health of others. It seeks to enlighten physicians to the negative consequences of not providing appropriate nutrition self-management training or MNT, and, ultimately, to enable them to provide the best available preventive treatment. The purpose of this approach is to improve physician practice behavior, which will lead to improved outcomes for patients with living with diabetes. Only a few nutrition education programs have focused on intersectorial action and coordination practices (Green & Kreuter, 1991, p. 201). Most traditional nutrition education programs have been directed at individuals, attempting to change knowledge, attitudes, skills, and eating, instead of the environment that is contributing to health problems (Glanz, 1988).

Yet, even with an individualized approach, there are a number of environmental supports that must be in place for people to have access to sound nutrition advice within the health care setting (Glanz, 1988). This is especially true of patients that require diabetes self-management training. Physicians are uniquely positioned to exert influence over their patients' attitudes and behaviors, and encourage dietary modification (Arfken et al., 1997; DHHS, 1993). Glascow and Orleans point out that physicians could have a significant impact on the health of the public, with little effort:

> Glynn and Manley (1989) projected that if only half of United States physicians delivered even a brief quitting message to their patients who smoked and were successful with only 1 in 10, this effort would yield 1.75 million new ex-smokers every year--more than double the national annual quit rate (Glasgow & Orleans, 1997, p. 358).

Physicians have power and authority by virtue of their knowledge, skill, and training (Arfken et al., 1997). In exchange for a physician's service, they are accorded a preferred and special status, which reinforces power and authority over their patients (Arfken et al., 1997, p. 27). This power is often invoked to influence health behaviors and promote adherence to health protocols. In turn, the use of power educative and empowerment approaches, as they pertain to nutrition education, may bring about widespread behavior change (Green & Kreuter, 1991). That is, in a power educative approach, primary targets of nutrition education include prospective physicians (our medical authorities), because they are not well trained in nutrition therapy (Halsted, 1998), but the secondary target and ultimate beneficiary is the public.

Hiddink (1997) investigated the role of the primary care physician (PCP) in providing nutrition information to patients (Hiddink, Hautvast, van Woerkum, Fieren, & van 't Hof, 1997). A random sample of Dutch consumers (n = 628) were asked about: the type of referral they received for nutrition information, their perceived expertise of these sources, their interest in nutrition information, and their nutritional attitudes and beliefs. Analyses revealed that PCPs are in a better position to provide nutrition advice, compared with dietitians or the chief public health nutrition agency (Hiddink et al., 1997)--though dietitians are perceived to have higher expertise. Consumers in this sample preferred PCPs to other sources of information because: (1) they are likely to be in contact with physicians versus other practitioners, and (2) physicians are perceived as a non-commercial, or unbiased source of information.

Skilled physicians can serve as *efficacy builders* by conveying positive or negative appraisals about a patient's nutrition status (Bandura, 1997). In addition, they are well

suited to cultivate a patient's belief in their own capabilities (Council on Scientific Affairs, 1990). However, physicians can not serve as efficacy builders for their patients if they themselves do not feel competent at conducting basic nutrition assessments. If physicians don't know what to look for, they can not provide emotional or informational support to their clients. Bandura summarizes that persuasory mentors, must be diagnosticians of peoples' strengths and weaknesses, and be knowledgeable about how to modify activities so that potentiality can be turned into actuality (Bandura, 1997). This concept can be applied to physicians who must understand how to improve a patient's nutrition status by various methods (e.g., meal planning, ordering appropriate diets, setting nutrition goals, providing a self-management prescription, among others) for behavior change to occur. If a patient's requisite skills are lacking, social persuasion by a physician alone can not substitute for skill development (Bandura, 1997).

Physician efficacy builders can have a positive impact on health behavior by providing individualized nutrition self-management education. Attempts to shape the course of their patient's life without providing efficacy-affirming experiences will become empty admonitions (Bandura, 1997). That is, a physician who is not competent at providing MNT will not be able to cultivate an authentic sense of self-efficacy in their clients, and, in turn, may preclude lifestyle change or adherence to nutrition protocols. Recently, innovative educational methods are being developed (National Heart Lung and Blood Institute & National Institute of Diabetes and Digestive and Kidney Diseases, 1999) to improve the way in which nutrition is addressed in medical school and the health care sector. This has potential to influence many people by improving the quality and coordination of available nutrition education to new physicians and their patients.

Conceptual Model

Wheat, Killian, and Melnick (1991) suggest that more data on attitudes, knowledge, and choice of specialty practice (or intention), with regard to health promotion and disease prevention (HPDP), is needed if researchers are to determine whether or not prevention education in medical school has an impact (Wheat et al., 1991). These researchers constructed a theoretical model to assess particular factors associated with HPDP programs, which in turn, is expected to predict future HPDP practice behavior. Relevant studies of nutrition competence, and related variables, are presented in the following sections.

Nutrition knowledge: past and present

Historically, nutrition education (or dietetics) was part of medical practice, and well documented with regard to diabetes treatment (Laitinen, 1994). Nutrition education is chronicled in medicine that stretches further back than Hippocrates (Rosner, 1996), who regarded it as inseparable from medicine (McLaren, 1994). One of the most venerable medical teachers, Sir Robert Hutchinson, published the first edition of a popular nutrition textbook (*Food and the Principles of Dietetics*, 1900). However, leaders felt that the future of nutrition should be outside medical school, such as in the School of Hygiene and Public Health at Johns Hopkins where research on vitamins was taking place (McLaren, 1994). Highly technical research in this setting left dietitians, whose mission was to use science to solve public health problems, in subservient roles (McLaren, 1994). This has contributed to the lack of applied nutrition education among medical students, and short supply of knowledgeable physician nutrition specialists

(Intersociety Professional Nutrition Education Consortium, 1998; Lazarus, Weinsier, & Boker, 1993).

Over the past 30 years, literature on knowledge of nutrition among medical students indicates that it is moderate to poor (Mlodinow & Barrett-Connor, 1989; Morgan et al., 1988; Phillips, 1971; Weinsier et al., 1986). Most studies demonstrate need for improving nutrition education in medical schools or residency. For example, Buttriss (1997) summarizes literature which points out that the nutritional knowledge base of most practitioners--who received little or no formal training in nutrition--is wholly inadequate, if they are to be expected to offer satisfactory dietary advice (Buttriss, 1997, p. s1994). Similar studies that assess nutrition knowledge among medical students are described.

To determine how well physicians are prepared to counsel patients about diet therapy, Phillips developed a test to measure the knowledge of medical students (Phillips, 1971). At that time, there were no nutrition priorities to guide knowledge assessment instruments for physician respondents. For that reason, Phillips used a panel of experts to select knowledge questions that were meaningful for future physicians. After the knowledge questionnaire was developed and reliability was determined at 0.65 (Kuder-Richardson), questionnaires were administrated to students who attended class at four different colleges (n = 236). Students achieved a mean score of 46 out of 100 correct. Results indicated that the majority of medical students were not familiar with many basic concepts and information related to nutrition, which experts deemed important. Phillips concludes, "Where nutrition content is integrated into other subject matter, it apparently does not have much impact on the curriculum" (p. 89). These findings support other

studies in literature, which indicate that most medical schools' nutrition courses are not typically planned or sequential.

Weinsier and his colleagues were concerned that there was little information regarding actual medical student knowledge of nutrition, and insufficient information on the relationship between medical training programs in nutrition and medical knowledge. In turn, they designed a study with the intent of obtaining a preliminary understanding of the relative levels of nutrition knowledge among graduating medical students. Additional factors such as perceived adequacy of nutrition education, amount of premedical nutrition training, and interest in nutrition education were measured. Test questions were obtained from a Nutrition Test-Item Bank at the University of Alabama School of Medicine. Ninety items were selected. Using a random method, students were selected from eleven southeastern medical schools providing 1114 respondents with a response rate of 236 (21%). This study points out the difficulty in studying prospective physicians. They did report, however, that there was a positive and significant relationship between knowledge score and the type of nutrition training (e.g., none, component of other course, separate nutrition course), $r = .31$, $p < 0.001$. In addition, there was a significant correlation between nutrition education prior to matriculation in medical school and the knowledge score ($r = 0.14$, $p < .05$).

Mlodinow and Barrett-Connor assessed knowledge of nutrition between physicians and medical students (Mlodinow & Barrett-Connor, 1989). Practicing physician internists were compared to first- and second-year medical students, before they had received training in clinical nutrition. Physicians answered about 69.2% of questions correctly. This was a significantly better score than that of the medical students (62.5%, $p = .0065$).

However, a significant negative correlation was found between the number of years since graduation from medical school and respondents' knowledge about nutrition; younger physicians outscored the older ones (Mlodinow & Barrett-Connor, 1989).

In another study, first- and fourth-year students (n = 874, 853), in eight southeastern medical schools were recruited through various class representatives and deans to take a nutrition exam (Morgan et al., 1988). Items were validated by faculty representative who reviewed content, and by using discrimination indices from previous data on fourth year medical students. The evaluation consisted of 90 items representing clinical and basic science nutrition knowledge. Forty-eight percent of freshman and 28% of senior students participated in the survey. Mean nutrition knowledge for first- and fourth-year students was about 53% and 68% respectively (Morgan et al., 1988). These researchers advise that future nutrition assessments should focus on comparing prospective surveys of student cohorts to curriculum characteristics of medical programs. This is a difficult undertaking because nutrition evaluations have not been well developed for medical students, and it is only recently that a consensus was reached on nutrition topics that are deemed essential for medical practitioners (American Medical Student Association, 1996).

To develop a knowledge assessment tool for physicians, it may be useful to draw from valid instruments that measure diabetes knowledge among patients. Even with a high prevalence of diabetes, meaningful assessment tools are rare. Fitzgerald points out, ". . .valid, reliable, and easy-to-use knowledge assessment instrument are scarce" (Fitzgerald et al., 1998, p. 706). To address this need, the Michigan Diabetes Research Training Center (MDRTC) attempted to develop a valid and reliable knowledge test that could be used by diabetes educators for patients (Fitzgerald et al., 1998). The method for

evaluating the questionnaire involved: (a) a test development process in which experts identified content domains to be tested for developing items; (b) pilot testing the items. The final instrument included 23 diabetes knowledge questions. One group received diabetes care from a local or medical plan connected practitioners. Participants were self-selected from four Michigan communities via advertisement. Patients completed the diabetes knowledge questionnaire during a visit with their nurse, at home, or before a scheduled health care visit. Alpha reliabilities were calculated for each samples separately and combined ($\alpha \geq 0.70$). However, additional tests to assess validity were not used. External measures that should be related to this variable, for example, were not analyzed. In addition, use of critical guidelines for diabetes self-management--published by the American Diabetes Association--was not mentioned. Because recent diabetes guidelines were published after their study was conducted, it is unlikely that these researchers adequately sampled and integrated key principles for diabetes patients (American Diabetes Association, 1999). Scientific advances in nutrition reveal that information used on past surveys is no longer complete. It is also noteworthy that none of these studies developed instruments that were used across physician populations and time. There continues to be a need for valid instruments that assess knowledge of nutrition education among prospective physicians.

Integration of nutrition information. Winick (1984) explains that there are two types of integrated approaches to nutrition education in medical school:

> ". . . there are required courses early and then elective courses in the second, third, and fourth years. The other type of an integrated approach attempts to integrate the subject of nutrition within the existing course structure…I favor the first approach, and am strongly against the second…I think experience has shown that this second approach does not work…" (Winick, 1984, p. 610).

This notion is supported by Cohen and colleagues who assessed the effectiveness of integrating nutrition into medical courses. A nutrition examination was administered before and after the new integrated teaching program (Cohen et al., 1981). Results indicated that there was no measurable impact on nutrition knowledge. In turn, concern about adequacy of nutrition education generated interest in developing a required course given in the third trimester of the first-year of medical school. Evaluations from this new program showed that students who took the required course, or 18 lecture hours, had a significantly greater knowledge of nutrition (59.8% of questions correct) than students who studied under the integrated program (44.5% of questions correct). It was concluded that a required nutrition course is the most effective way to teach nutrition to prospective physicians, and that an increase in their knowledge, "...will provide a framework for informed opinions on nutrition topics and the provision of better health care" (Cohen et al., 1981, p. 775).

In 1998, The Intersociety Professional Nutrition Education Consortium (IPNEC) reported that many medical schools integrate nutrition concepts into basic medical courses such as biochemistry and physiology; however, when taught in this manner, students often do not recognize the concepts as nutrition. Another problem is that the role of diet in disease prevention is not adequately highlighted (Intersociety Professional Nutrition Education Consortium, 1998).

Nutrition attitudes

Survey questionnaires have been useful for assessing the need for nutrition education among physicians. In 1977, Krause and Fox examined nutrition attitudes and knowledge among general practitioners. Questionnaires were mailed to 1,350 physicians,

of which 292 (22%) responded (Krause & Fox, 1977). For the nutritional knowledge portion of the survey, physicians were asked to answer 55 factual statements with "true", "false", or "uncertain". Results showed that 65% of the total responses were correct. Attitude statements (e.g., nutrition is an essential component of comprehensive health care, and dietitians are an important member of the health care team) were rated on a continuum of "agree", "disagree", or "undecided" (Krause & Fox, 1977, p. 609). Overall, physicians had a favorable attitude toward nutrition counseling. This type of survey is useful for evaluating the efficacy of future educational interventions on the attitudes and nutrition practices of physicians (Levine et al., 1993).

In a national survey of attitude and practice of PCPs, Levine and colleagues (1993) surveyed 30,000 PCPs. Respondents were asked to indicate the degree to which they agreed or disagreed about nutrition in clinical practice (Levine et al., 1993). These researchers used a 5 point Likert-type scale, and respondents were asked to judge 36 statements (e.g., "Diet has an important role in the prevention of hypertension" and "Nutrition will have an increasingly important role in the prevention and treatment of disease") (Levine et al., 1993, p. 116). Of the 11% who returned their questionnaires, most considered nutrition to be important in clinical practice, tending to agree with positive attitude statements (> 60%). It is noteworthy that attitude scores did not correlate with scores for behavioral traits (e.g., advises, teaches, prescribes nutrition or determines those with nutritional problems). This is consistent with others similar findings. For example, in a review of nutritional attitudes and practices of physicians, Glanz points out that interventions that have emphasized information sometimes improved nutrition attitudes, but this did not result in improved physician practices (Glanz, 1997; Glanz & Gilboy, 1992).

Attitudes and practice behavior. The relationship between attitude and future practice behavior also has been studied in nurse populations in Canada. Laschinger (1993) examined practicing nurses' attitudes, subjective norms, and intentions to care for HIV positive patients. Nurses' attitudes and subjective norms were found to be significant predictors of intentions to care for persons who were HIV positive. In turn, it was recommended that practitioners target specific educational/training interventions to include feelings, attitudes, beliefs, and behavioral intentions about HIV-related topics (Laschinger & Goldenberg, 1993). This study supports the notion that assessment of practitioners' attitudes toward MNT is important for behavior change.

According to Millstein (1996) the TRA and Theory of Planned Behavior (TPB) models indicate that the best predictor of a given behavior is the behavioral intention to perform it (Millstein, 1996, p. 398). For behaviors that require a skill, such as knowledge of nutrition, an addition component of TRA is considered to be essential: an individual's beliefs in their ability to perform a behavior (Millstein, 1996). Millstein therefore describes Ajzen's (1985) expanded TRA, which involves perceived behavioral control, and refers to it as the TPB. In a comparision of TRA and TPB, 765 PCPs were followed for six months for the purpose of assessing physician practice behavior (Millstein, 1996). Millstein found that attitudes ($\beta = .15$, $p < .0001$) and social norms ($\beta = .26$, $p < .0001$) were significantly associated with subsequent behavior and that intentions had a significant relationship to practice behavior (Millstein, 1996). She concludes that practitioners who: (1) believe they have control over educating patients, (2) are confident in their ability to perform a behavior, and (3) perceive that the behavior is reasonable to perform, will have a higher rate of intention to educate, and will do so more often

(Millstein, 1996). This suggests that attitudinal theories are not only relevant to patients; they also should be considered when studying physician practices that involve MNT.

Beliefs about nutrition education in medical students. The American Medical Student Association and the American Society for Clinical Nutrition surveyed graduating fourth year medical students (N = 535) about nutrition and their medical education. Results from respondents (n = 119) indicated that the majority of students believe that nutrition education is inadequate. The authors concluded that, "...the current medical education system fails to adequately train students in nutrition, even though students perceive nutrition to be an important subject for physicians" (Hark, 1997, p. 43).

One school of medicine implemented a case-based nutrition program into the medical school curriculum, across all four years. The AAMC's Medical School Graduation Questionnaire was used to evaluate these medical students' attitudes regarding preparation of applied nutrition. Students were asked to assess whether the time devoted to nutrition was, "inadequate", "appropriate", or "excessive". After being involved with a new comprehensive nutrition program, graduates felt that the time devoted to nutrition coverage had significantly improved. In 1995, 29.5% of students felt that nutrition was inadequate, whereas in 1991, 80% felt that nutrition was inadequate (Hark, 1997).

Nutrition self-efficacy

Only recently have studies explored nutrition counseling self-efficacy, among prospective or practicing physicians. In 1992, two hundred general practitioners and practice nurses in the United Kingdom (UK) were asked how confident they were in their ability to explain various nutrition terms and therapeutic concepts (Buttriss, 1997). Findings confirmed that, unless a nutrition term appeared in the health press or national

newspapers, most providers were not confident enough to explain the meaning of nutritional terms (e.g., monounsaturated or *trans* fatty acids) (Buttriss, 1997). Moreover, 46% of those interviewed said that they were not confident when explaining the difference between saturated, monosaturated, and polyunsaturated fatty acids. Buttriss (1997) concluded that there is a knowledge gap among the public, and a real sense of uncertainly and unpreparedness among the health professionals to whom the public will be turning for advice (Buttriss, 1997).

In a large scale survey, primary care physicians (PCPs) in the U.S. were given a self-administered questionnaire, which was developed to assess perceived self-efficacy and nutrition-related practices (Glanz et al., 1995). Of the 960 (52% of sample), of physicians who responded, mean scores ranged between 47 to 60--out of 100 total possible points. PCPs were most confident about being able to provide nutrition information, and were least confident about advising patients how to maintain their diet or prevent relapse. Glanz concluded that respondents' confidence in their ability to help patients with dietary change was moderate (Glanz et al., 1995).

At an International Workshop on Nutrition Attitudes and Practices of PCPs, Glanz (1997) discusses that suffering and health care costs would be reduced if PCPs identify, manage and counsel their patients to improve nutrition status (Glanz, 1997). Her colleagues reviewed nine studies about physicians' practices and found that rates of nutrition counseling for at risk patients ranged from 17% to 70% (Glanz, 1997). In view of these findings, individual factors found to be associated with nutrition practices of PCPs, namely knowledge, self-efficacy, and attitudes were addressed. Factors found to correlate with recommended nutrition management practices included a belief in the efficacy of the

diet on disease, and self-efficacy, or "physicians' confidence in their ability to effectively counsel patients. . ." (p. s2017)

By participating in a nutrition education program, researchers were able to improve nutrition self-efficacy among practicing physicians. Ockene and colleagues examined the effect of a training program on physicians' lipid intervention knowledge, attitudes, and skills (Ockene et al., 1995). A 3-hour educational program was used to teach physicians dietary screening and basic nutrition assessment skills. The purpose was to enable physicians to provide nutrition counseling, which would then enable at risk patients to change their dietary patterns. PCPs were practicing in a health maintenance organization (HMO) and were assessed, before and after training. After the program, physicians' use of dietary counseling significantly increased their mean score from 5.4 to 9.2. Moreover, PCPs demonstrated increases in self-perceived confidence as measured by a 5 point Likert-type scale (pre = 3.3, post = 3.9). Results of this educational program indicate that physicians lack basic nutrition training, but they can learn to apply important nutrition principles for promoting behavior change in their patients. Thus, improving mastery of nutrition management skills among physicians can have an impact on intention to practice MNT.

Validity as a Unified Concept

> No test can ever completely capture the construct, of course, because the construct refers not just to specific tasks but to processes and other attributes underlying a domain of potential tasks (Messick, 1994, p. 19).

Messick posited that validity issues are many-faceted and intertwined, and, in turn, nearly impossible to disentangle (Messick, 1981; Messick, 1995). Differentiating various types is challenging when definitions of validity have been multifarious with

various concepts that are not well integrated. Messick describes that validity is typically divided into separate parts, such as content, criterion, and construct validity (Nunnally, 1994; Shavelson, 1996). However, this view is fragmented and incomplete, because it fails to take into account both evidence of the value implications of score meaning (Messick, 1981; Messick, 1995). Dunnette and Borman (1979) supported the notion that validities which are classified by *type* have been confusing for researchers, and as a result, have led to oversimplification (Messick, 1981). Messick explains that a simplistic view of validity causes test users to focus on one type of validity, when in fact various aspects of validity are not comparable in importance or inferential power (Messick, 1981). For example, criterion-related validity is only a limited part of test validity. In light of these problems, Messick began to develop a unified concept of validity (Messick, 1981), which integrates aspects of content, criteria, and consequences of test-score meaning.

Loevinger (1957) established that, "...since predictive, concurrent, and content validites are all essentially ad hoc, construct validity is the whole of validity from a scientific point of view" (Loevinger, 1957, p. 636). Twenty-five years later, Messick reported that a more unified concept of validity was becoming a central principle in educational and psychological measurement (Messick, 1981). In this model, the fundamental role of construct validity, for scientific and applied measurement were stressed. At first, Messick proclaimed that two major questions be addressed whenever assessments are employed: (1) Does the test measure characteristics it is interpreted to assess? and (2) Should the test be used for the researchers' purpose and in the proposed manner stated? The former question is answerable by appraising one aspect of construct

validity, namely evaluation of the evidential basis of test interpretation (Messick, 1981). The latter question is an ethical one, which can be answered by appraising potential consequences, called the consequential basis of test interpretation, of the assessment's proposed use in terms of social values (Messick, 1981). Construct validity is described as the evidential basis of test interpretation, and it can be used for appraising potential social consequences of assessment use (Messick, 1981).

Messick's modern version has six interrelated aspects and presents a more comprehensive view of construct validity. Messick states that, "These six aspects function as general validity criteria or standards for all educational and psychological measurement, including performance assessments" (Messick, 1995, p. 741). It seeks to test hypotheses and relevant relationships empirically, and through expert judgement (Messick, 1995). Specific considerations for construct validity are described, these include content, substantive, structural, generalizability, external, and consequential aspects of construct validity (Messick, 1995) (Appendix C).

Aspects of Validity

The first aspect, content relevance & representativeness, is described by Messick as the boundary of the construct domain that will be assessed (Messick, 1995). If this is established, it ensures that all relevant parts of the construct domain are covered. This may be achieved through job, task, and curriculum analysis, as well as domain theory (Ghiselli, Campbell, & Zedeck, 1981; Messick, 1995)

Second, substantive theories, refers to process models and process engagement theory. By identifying domain operations or performances that are expected to be revealed in assessment tasks, a researcher can gather evidence for validity. Messick

notes that tasks should provide appropriate sampling of domain processes as well as traditional coverage of domain content. This involves think aloud protocols, correlation patterns among parts of an assessment or score, and consistencies in response time (Messick, 1995). Empirical evidence should indicate whether or not respondents are actually engaged in the sampled processes.

The third component, the structural aspect of construct validity, requires that scoring models are reflective of task and domain structure (Messick, 1995). This means that scoring should be reasonably consistent with what is known about structural relations inherent in behavioral manifestations of the construct under study (Messick, 1995). In addition, inter-relationships among scored aspects of performance task should be determined so that structural fidelity can be established (Messick, 1994). This means that tasks should conform to what is already known about the internal structure of the construct's domain (Messick, 1995).

The fourth aspect, generalizability, requires that the boundaries of score meaning be clearly defined. Messick explains that score interpretation should not be limited to the sample of assessed tasks (Messick, 1995). Rather, it should be broadly generalizable to other activities in a relevant field. Messick also recognizes that limits of score meaning are affected by the degree of generalizability across time, observers, among others (Messick, 1995). Overall, generalizability depends on the degree of correlation of the assessed tasks with other tasks representing the construct.

The fifth component is the basis for construct validation. It involves convergent and discriminant correlations with external variables. Its purpose is to appraise the degree to which empirical relationships with other measures are, or are not, predictably

consistent with another particular measure. Messick points out that constructs represented in the assessment should rationally account for an external pattern of correlations, or convergent and discriminant correlation patterns. This network of anticipated relationships has been termed, a nomological network (Cronbach & Meehl, 1955). Criterion measures relevant to the evaluation may be used to demonstrate correlations or the lack thereof (Messick, 1995). Verifying the presence of meaningful relationships between assessment scores and criterion measures supports the utility of particular scores for applied purposes (Messick, 1995).

Consequences as evidence of validity (Messick, 1981) is the sixth, and final, aspect of validity. This involves evidence or justification for engaging in intended and unintended consequences of scores interpretation. Messick states that short- and long-term social consequences of program evaluation should be presented (Messick, 1994; Messick, 1995). Moreover, it is important to accrue evidence of positive consequences, and provide sound rationale that adverse consequences are minimal. A researcher must guarantee that negative consequences on respondents in the study should not be a result of test invalidity (Messick, 1994). In addition, a researcher must guarantee that low scores will not occur because the test missed something relevant to the construct--which, if present, would have increased competence scores (Messick, 1994). In contrast, low scores should not occur because the assessment contained irrelevant factors that interfered with the participants' performance.

Item Response Theory: The Rasch Method of Analysis

Wright (1982) asserted that a crucial difference between IRT and Classical Test Theory is that, in IRT, reliability estimates are unique to the test score the person actually

obtains rather than an average score (Wright & Masters, 1982). Until recently, the principle that raw scores are not measures was not understood or applied in educational measurement, thus precluding construction of useful measures (Wright, 1997, p. 34). Raw scores can be biased against extreme measures, favoring central scores. As a result, Wright cautions researchers that it is misleading to use a statistical method, such as regression or factor analysis, which uses raw scores from scales as though they were continuous interval measures:

> Any statistical method. . .that uses raw scores or Likert scales as though they were linear measures will have its output hopelessly distorted by this bias. That is why so much social science has turned out to be not more than transient description of never-to-be-reencountered situations, easy to contradict with almost any replication (Wright, 1997, p. 35).

Wright also points out that distances between ordered categories, such as a Likert-type scale, can be deceptive because response scores do not form a linear scale. In turn, means and standard deviations calculated from these ranks can be systematically misleading (Wright, 1997). Wright therefore recommends that prior to applying linear statistical methods to concrete raw data, one should use a measurement model to construct test-free linear measures, such as logits.

In sum, the precision of measures is thought to be greater when applying the Rasch method of analysis, which uses central scores, rather than using extreme scores in their estimates (Wright, 1997). Consequently, statistical validity, or the extent to which a data pattern fits the measurement model, can be assessed. This method can also be used to determine reliability and support aspects of construct validity (Messick, 1995). IRT allows researchers to quantify a characteristic of individual test items, and to predict how

an examinee will respond to a chosen item. For example, a researcher could predict how a medical student would respond to a specific self-efficacy question, given their relative level of confidence. This is useful because it enables the researcher to identify outfit statistics, which indicates whether or not particular items or persons are performing as expected. It also can be used to reduce random errors, because key entry problems and respondents' mistakes can easily be identified. Additionally, it can be used to identify unique response styles, such as the case when a respondent chooses only one category for all items. Another feature of IRT models is that they can account for item difficulty, and, in turn, allow researchers to compare individuals who responded to different subsets of items (Ghiselli et al., 1981). Classic theory would not compare students on the basis of an underlying level of ability, or in this case, self-efficacy. Thus, it would favor the student who took an easier test.

Construct validity.

Construct validity is the extent to which an instrument measures what was intended. Samuel Messick suggested that, ". . .construct validity is the evidential basis for score interpretation" (Messick, 1995, p. 743). The content aspect of construct validity requires verification that items in an instrument are working together to define a recognizable and meaningful variable (Messick, 1995). This involves identifying attributes, such as self-efficacy, which are revealed by cognitive assessment tasks and may be appraised by expert professional judgement. The Rasch method of statistical analysis enables scientists to assess the content validity of the nutrition self-efficacy scale. It provides an important basis for content validity by: (1) defining a discernible line of increasing intensity, (2) ordering items along a line which follows the intentions of

the researcher, (3) separating persons along the line defined by the items, and (4) assessing each person's measure for consistency with the idea of a single dimension (Wright & Masters, 1982). An expert can then determine if items in an instrument are working together to define a meaningful variable. This may be referred to as substantive or external validity (Messick, 1995) and is demonstrated in this paper.

Only when item calibrations are sufficiently spread out, is it possible to define a discernable line of increasing intensity. In other words, items that have reasonable item placement on a line--and are ordered in a way that follows the researcher's intention--demonstrate support for construct validity (Wright & Masters, 1982). For example, self-efficacy category choice values should decrease with statements that are more difficult to endorse. Item separation statistics may be useful for determining optimal categorization after the order is confirmed (Zhu, Updyke, & Lewandowski, 1997).

Test validity also can be assessed by reviewing item fit statistics (Wright & Masters, 1982), because they confirm whether or not a measure for a respondent's performance is valid. In addition, they may alert the researcher to the possibility of an extraneous variable. Values over 2.0 indicate that there is more unexpected randomness than was anticipated (Linacre, 1997). For example, if the expected category (e.g., choosing "1") is far different than the category actually used (e.g., choosing "5") in a certain context, outfit will be high.

A prerequisite for interpreting Rasch analysis, or confirming the absence of confounding variables, is that latent traits being assessed are unidimensional in nature. One underlying dimension can be identified by conducting a Rasch residual factor analysis (Linacre, 1998a). This procedure is expected to support the hypothesis that self-

efficacy item groupings underlie an unobservable construct. In turn, it can been confirmed that one unique factor explains most of the variance observed in the survey. Factor analysis of residuals also enables us to detect the presence of an additional trait. If outfit and biserial correlation statistics are within an acceptable range, it is not necessary to perform a Rasch residual analysis. In this case, a traditional principal-components factor analysis may serve as a general indicator for the presence of unidimensionality.

Reliability. Conventional correlation statistics (e.g., Cronbach's alpha) are not effective for defining optimal categorization of a psychometric scale (Zhu et al., 1997). They provide information on the ratio of true variance to observed variance and how different the measures are (Wright & Masters, 1982). This may or may not indicate how useful the test is for measuring specific traits, but it does indicate whether items work together to define one variable. Rasch reliability analysis uses a separation ratio as a scale index for comparing the "true" spread of measures with their measurement error (spread of sample), and separation reliability coefficient (e.g., Cronbach's alpha) to indicate if differences are due to measurement error (alpha < .5) (Cronbach & Meehl, 1955). In addition, discernible strata provide information on the number of significantly different levels of measures in a certain range.

The magnitude and value of point biserial correlations, or item total correlations, provide a yardstick for comparing the strength of a relationship between variables (Shavelson, 1996). The sign indicates the direction of the relationship, with negative values implying data problems (Linacre, 1998b). They help to discriminate on an item level, but do not provide information on the quality of categories. Instead, Rasch analyses can be used to verify the respondents' perceptions of the ordering of category meanings by

using fit statistics, or chi-square fit statistics, which are used to assess misfit, such as outfit (i.e., unexpected outliers). These statistics allows us to examine the extent to which respondents are separated along the same line, as previously described. Typically, only *person* separation reliability is reported, but *item* separation statistics also are useful indicators. They verifies how well the medical students spread out items along measures of self-efficacy (Fisher, 1992).

Wheat, Killian, and Melnick (1991) concur that more information on attitudes, knowledge, and intention, is needed to anticipate providers' practice behavior (Wheat et al., 1991). Accordingly, this study uses a theoretically derived predictors of nutrition practice behavior by assessing the following variables: (1) attitude, (2) self-efficacy, and (3) knowledge. By applying selected paradigms in health behavior and health services research (Andersen, 1995; Rosenstock, 1974b), a behavioral model was used to integrate major health related theories, and demonstrate how affective and cognitive factors influence physician practices (Appendix B).

In view of literature described, it was expected that prospective physicians' level of nutrition knowledge would be low (< 70% correct) (Krause & Fox, 1977; Phillips, 1971), and would not be shaped by the amount of nutrition learned as part of a basic science course (Intersociety Professional Nutrition Education Consortium, 1998; Weinsier et al., 1986). Knowledge scores should be significantly better scores among fourth- versus first-year medical students (Morgan et al., 1988).

Attitudes should not have a direct impact on practice behavior, but may modify important factors such as motivation to seek out nutrition education (Glanz & Gilboy, 1992; Krause & Fox, 1977; Levine et al., 1993). Although some studies did not

demonstrate a reliable link between attitudes and practice behavior (Glanz, 1997; Glanz & Gilboy, 1992), others have shown that there is a relationship between attitudes and intention (Laschinger & Goldenberg, 1993). This is particularly true when an efficacy-like trait is combined with attitude (Millstein, 1996), and is consistent with preliminary results. In turn, rates of attitude and self-efficacy are expected to remain stable for the main study. Researchers have reported shown that self-efficacy can vary across prospective physicians, but aggregate levels are low to moderate (Buttriss, 1997; Glanz, 1997; Glanz et al., 1995). For this reason, it is expected that rates of nutrition counseling for at risk patient populations should be low to moderate (10 to 70 percent) (Glanz, 1997; Ockene et al., 1995). To determine the relative levels of these variables, classical test theory and IRT, was used. In turn, related aspects of validity were established for the instrument under study.

CHAPTER 3
METHODOLOGY

The purpose of this study was to develop an evaluation method that would assess nutrition competence among practitioners and describe relative levels of nutrition self-efficacy, attitudes, and knowledge among prospective physicians. This chapter presents the methodology used in this study and describes how an assessment tool was developed. Towards this end, the following topics were delineated: (1) phase I, scale development, (2) phase II, scale validation, and (3) phase III, data collection and analysis. Traditional classic test analyses, such as reliability and factor analysis, and expert judgement were employed to examine evidence for evaluating the validity of the instrument. In addition, specialized rating scale analyses were used for the self-efficacy component. Rationales that support the use of these theories and methods are presented.

Phase I: Scale Development

Specific statements on the instrument were adapted from previous nutrition surveys, (Glanz et al., 1995; Krause & Fox, 1977; Levine et al., 1993; Young, Weser, McBride, Page, & Littlefield, 1983) and developed from current nutrition principles for people with diabetes mellitus (Franz et al., 1994). In addition, feedback on specific questions was provided by several experts in the field (Appendix C). The investigator, who is a registered dietitian, constructed the items before the questionnaire was developed. This was based on the American Diabetes Association's clinical practice guidelines for nutritional management of diabetes in an effort to align items with the

desired outcomes for persons with type 2 diabetes (American Diabetes Association, 1997; Franz et al., 1994). Principles of diabetes MNT include: (a) maintenance of near-normal blood glucose, (b) achievement of optimal lipid levels, (c) appropriate calories to achieve a desirable weight, (d) prevention, delay, or treatment of nutrition-related risk factors, and (e) improvement of overall health through optimal nutrition, which involves special considerations for macronutrients (e.g., protein, fat, carbohydrate), and micronutrients (e.g vitamins and minerals) (American Dietetic Association, 1996, 1999). Accordingly, a blueprint of relevant self-efficacy, attitude, and knowledge categories, with a representative collection of items was compiled (Nunnally, 1994).

Several considerations were made to assure that the items could be easily understood. First, items were written using clear and unambiguous language. Only the most common abbreviations for medical terms, such as patient (Pt), were used. If it was likely that a term could have multiple meanings (e.g., MNT), it was defined for the respondent. To guarantee that the survey could be easily completed and in a minimal amount of time by medical students, a single page of closed-ended items were developed.

During the construction of preliminary items, expert feedback was sought (Appendix C). Physicians and faculty members provided feedback while the instrument was under construction. Any weaknesses in the following areas were discussed: readability, unambiguous wording, use of unidimensional statements, content, representation of the construct, and clear instructions were discussed until consensus was reached (Fowler, 1995). To enhance content representativeness, practitioners reviewed items to ensure that the scope of the nutrition domain was represented. Moreover, a professor of measurement and quantitative methods examined the psychometric scales for

issues related to dimensionality and optimal category usage. Revisions to the questions were made accordingly and the initial instrument was constructed and formatted for a pilot study.

Pilot Study

The purpose of the pilot study was to evaluate the feasibility of conducting survey research on prospective physicians, and to begin to develop a valid nutrition assessment instrument (Schulman & Wolfe, 2000). Institutional Review Board (IRB) approval was received by the University of Florida, Health Science Center in advance (Appendix D). This pilot received exempt status, since it involved the use of educational tests, or a survey, in which confidentiality was maintained. Data were subjected to reliability analyses, factor analysis, and t-test, to determine whether or not bias would be a threat. Subsequently, measures of nutrition attitudes, self-efficacy, and knowledge were correlated with external variables, such as prior nutrition education and intention to practice MNT, to assess the presence or absence of convergent validity (Messick, 1995).

A self-administered paper and pencil type preliminary survey was administered to graduating seniors ($N = 117$) at the University of Florida (UF), College of Medicine, during the final month of classes, before students began their residency. Because most students were no longer on campus and were interning at medical centers, the questionnaire was placed in their campus mailboxes on two occasions 2 weeks apart to ensure that most of them had an opportunity to participate (Salant & Dillman, 1994). In addition, electronic mail reminders were sent to the graduating class, to encourage participation in the survey. Confidentiality and the anonymity of participants were maintained during the study at all times.

The preliminary questionnaire consisted of polytomous items for attitude and self-efficacy, and categorical items for knowledge. For the attitude and self-efficacy subscale, questions were rated on a 5-point, unidirectional scale. For attitude, the rating scale was 1=completely disagree, 2=disagree, 3=partially disagree/agree, 4=agree, and 5=completely agree. For self-efficacy, the rating scale was 1=confidence very low, 2=confidence low, 3=confidence medium, 4=confidence high, and 5=confidence very high. Knowledge questions required a discrete non-forced choice answer T=true, F=false, and ??=not sure. Respondents are asked to: (1) evaluate eleven nutrition related attitude statements, (2) judge twelve self-efficacy statements, that is students' perceived ability to perform specific tasks (i.e., ability to order a nutritionally adequate diet for a patient with type 2 diabetes), and (3) answer sixteen basic diabetes MNT knowledge questions.

The UF population was 52% male and 48% female. The College of Medicine classified students by ethnicity as: (1) "Black" (10%), (2) "Native American/Alaska Native" (3%), (3)"Other Hispanic [not Mexican American or Puerto Rican]" (5%), and (4) "White and all others" (82%). However, respondents were not required to provide this information on the questionnaire. Forty-seven percent ($\underline{n} = 55$) of senior medical students responded to the instrument. Physicians completing the instrument ranged in age from 24 to 40, with a mean age of 28. Men and women accounted for 45% and 51% of this sample respectively; three physicians did not respond to this question.

Data were entered into a spreadsheet so they could be easily imported into SPSS (SPSS, 1998) or FACETS (Linacre, 1999), for Rasch modeling. SPSS was used to

provide descriptive statistics, and conduct factor analyses, reliability analyses, and multivariate correlations.

Results and observations

Descriptive analyses showed that the majority of physicians had positive attitudes toward MNT, and, as a result, did not choose lower categories on the scale. Consequently, this scale was not appropriate to use for Rasch modeling, since it is most reliable when all categories are chosen. Instead, a common factor analysis was conducted (Figure 3.1), and results indicate that there were two major factors. Factors number 1 and 2 represent attitude and self-efficacy respectively. Moreover, eigenvalues are > 2 for each factor.

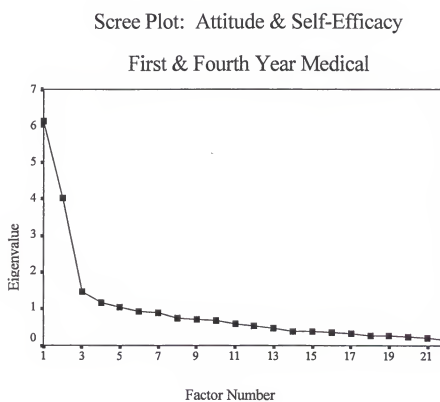


Figure 3.1. Common principal components factor analysis for self-efficacy and attitudes.

Internal consistency for each affective scale and the knowledge test was at least .70 (Table 3.1). Reliability statistics were computed separately for each group, and for both groups combined (Table 3.1). These results were used to develop the validation study. Expert consultants participated in examining evidence for, or against, validity.

Table 3.1

Reliability for Major Independent Variables as a Function of Year in School.

	Alpha Reliabilities for Independent Variables		
Sample & Cases	Attitude	Self-Efficacy	Knowledge
All medical students n = 92	.86	.89	.73
Fourth-year students n = 54	.89	.87	.70
First-year students n = 39	.79	.90	.70

Note: Correlation coefficients are provided for all medical students combined, and for first- and fourth-year students separately.

An analysis of the rated responses for nutrition self-efficacy questions revealed that category usage was unimodally distributed, with most prospective physicians choosing values "2" and "3" (Schulman & Wolfe, 2000). Average measures advance, which means that higher categories reflect higher measures of self-efficacy. If an average measure does not increase with each higher category, or in this case, if an average measure does not increase with each easier activity, then an average measure for a category is flagged (Linacre, 1998b). This casts doubt on the idea that higher categories correspond to "more" of a variable, such as confidence. For the validation study, average measures were compared to evaluations from an expert panel of four registered dietitians and one endocrinologist. They rated the difficulty of each activity and the expected level of

confidence that a prospective physician should experience. Outfit statistics, which indicate unexpected observations in a category, were within an ideal range, .8 to 1.4 (Linacre, 1997). Moreover, rating scale category thresholds and the distance between adjacent thresholds is neither too small nor too large, resulting in a clear pattern of hills, portrayed by the category probability curves (Linacre, 1997) (Figure 3.2).

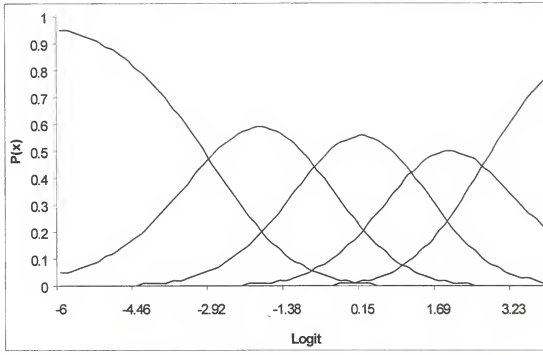


Figure 3.2. Category probability distribution for the self-efficacy rating scale.

Convergent validity was confirmed by evaluating whether self-efficacy was related to nutrition preparation and intention to provide MNT (Table 3.2). Results showed that self-efficacy scores were positively correlated with the number of separate nutrition courses taken prior to entering medical school .40 ($\underline{p}$ = .002). However, there was concern that variance was low, because most medical school applicants are not required

Table 3.2.

Multivariate Correlations: Evaluation of Competence and Intention to Practice MNT

Source	Attitude	Knowledge	Component of Class		Intent to Practice	Nutrition Adequacy†	Prior Courses†
			Total	Hours			
Self-Efficacy	.29*	.18	.04	.15	.29*	*.43***	*.40***
Attitude	—	-.02	-.08	-.03	.18	-.20	.37**
Knowledge	-.02	—	-.18	-.13	-.01	-.01	.34*
Component of Class							
Total	-.08	-.18	—	.36**	-.14	.17	.08
Hours	-.03	-.13	.36**	—	-.06	.31*	-.10
Intent to Practice	.18	-.01	-.14	-.06	—	.08	.09
Nutrition Adequacy	-.20	-.01	.17	.31*	.08	—	.24
Prior Courses†	.37**	.34*	.08	-.10	.09	.24	—
Nutrition Elective†	.21	-.33**	.18	.08	-.09	-.01	.16

Note: *Pearson product-moment correlations are significant at the 0.05 level (2-tailed). **Correlations are significant at the 0.01 level (2-tailed). †low variability. Italics denotes significance in both first- and fourth-year medical students.

to take nutrition courses. There was no relationship between self-efficacy and the number of nutrition courses .04 ($p = .80$) or number of nutrition hours .15 ($p = .28$), taken as a component of another medical course. However, nutrition self-efficacy scores were associated with perceived adequacy of nutrition education received in medical school .43 ($p = .001$), and intention to practice general MNT with patients .29 ($p = .04$). It is noteworthy that few students reported adequacy of nutrition education as satisfactory, and, thus, variance may be low with this variable as well. There was a relationship between assessment scores and external measures, which reflect expected levels of the construct being assessed.

Thus, there is preliminary evidence for the convergent aspect of construct validity. However, the meaning of self-efficacy scores require further substantiation by:

(1) an evaluation of the degree to which empirical relationships are consistent with other measures and (2) an appraisal by nutrition experts as to the importance, difficulty, and meaning of each item (Messick, 1995), and (3) power analyses, to assess whether or not the pilot was sensitive to the effects measured. These tasks were accomplished in the main study.

Preliminary results showed that knowledge scores were relatively low for prospective physicians (mean = 9.4 correct or 59%) (Figure 3.3). These results are consistent with nutrition assessment literature (Krause & Fox, 1977; Mlodinow & Barrett-Connor, 1989; Morgan et al., 1988; Weinsier et al., 1986; Winick, 1993), and was confirmed in phase II of the study. Reliability statistics were above .70. However, use of

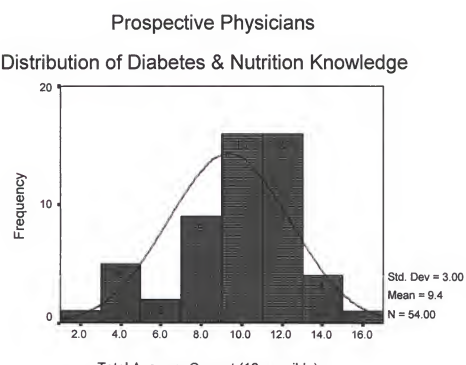


Figure 3.3. Distribution of knowledge scores on the MNQ-D.

an alpha coefficient may not be appropriate for this type of assessment. Although a specific type of knowledge (MNT-D) was tested, a range of questions within this domain

was presented. In turn, it may be more meaningful to re-test the same group of participants and compare scores between similar administrations, instead of using conventional reliability analyses (e.g., Cronbach's alpha coefficient, KR-20, etc.).

Phase II: Scale Validation

In this section, a description of the setting, participants, procedure for instrumentation, need for using a computer-based questionnaire, materials, operational definition of the variables, and permission and confidentiality are be presented.

Setting

The University of Florida, College of Medicine is located at a large, public, comprehensive, land-grant, research institute, which is comprised of 22 clinical and basic science departments staffed by approximately 600 faculty members. Students have opportunities to develop skills in advanced medical technology and research. The college provides traditional study and practice through four years of medical training, followed by an option for advanced specialty training. First and second academic periods require formal coursework in biochemistry, anatomy, genetics, physiology, neuroscience, physical/clinical diagnosis, ethical issues, public health, and others. The third academic period requires a medical clerkship in geriatrics, neurology, surgery, obstetrics-gynecology, pediatrics, and interdisciplinary generalist experience. The fourth, and final, academic period is followed by various advanced clerkships. Electives are offered at non-university settings with unaffiliated community hospitals, local or federal agencies, and others. Whereas nutrition is offered as an elective or as a component of a required medical school course, nutrition as a separate course is not required.

Participants

The sample was selected from a population of all medical students matriculating at an accredited U.S. medical school. Students at the University of Florida, College of Medicine were representative of other medical students based on the following criteria: (1) Medical College Admission Test (MCAT) performance scores (30.0) were nearly the same as the national average (29.5) (AAMC, 1997b; AAMC, 1999), (2) admission requirements were standard (organic and inorganic chemistry, biology, and physics), and (3) the medical school's curriculum characteristics, such as required courses and clerkships, were comparable to other programs (AAMC, 1997b; AAMC, 1998)

Demographics and respondent characteristics

The UF population of graduating physicians (N=117) were 53% male and 47% female. The College of Medicine classified students by ethnicity as: (1) "Black" (4.3%), (2) "Native American/Alaska Native" (.85%), (3)"Other Hispanic [not Mexican American or Puerto Rican]" (6.8%), (4) "Asian/Pacific Islander" (13.6%), and (5) "White" (80.3%). Respondents were not asked to provide this information on the questionnaire. Fifty-six percent (n=66) of senior medical students (N=117) participated in the survey. Physicians completing the instrument ranged in age from 23 to 40, with a mean age of 27.4. Men and women accounted for 42.4% and 56.1% of this sample respectively; one physician did not respond to this question.

The first year class (N=117) was identical to the senior class in terms of size and gender. Students was described by ethnicity as: (1) "Black" (8.5%), (2) "Native American/Alaska Native" (.85%), (3)"Other Hispanic [not Mexican American or Puerto Rican]" (7.6%), (4) "Asian/Pacific Islander" (20.5%), and (5) "White" (59.8%). Respondents were not asked to provide this information on the questionnaire. Fifty-

seven percent (n=67) of first year medical students participated in the survey. They ranged in age from 20 to 31, with a mean age of 23.2. Men and women accounted for 56.7% and 43.3% of this sample respectively; three students did not respond to this question.

Administration

Following a similar procedure to the pilot survey, a specially developed questionnaire was completed by first- and fourth-year medical students (N = 234) at the same southeastern college of medicine, in February 2000. For phase II, an enhanced data collection methodology was used to facilitate medical students' participation.

Computerized Self-Administered Questionnaire

Prospective physicians are challenging to study because they are interning at medical centers, where their priority is treating patients. Thus, in this measurement setting, it has been impractical to obtain a large number of graduating medical students to complete the MNQ-D. Additionally, prospective physicians are difficult to locate because they have recently completed application for residency and are in the process of interviewing or relocating. In one seminal study of nutrition knowledge among medical students, Phillips concedes:

> The end of the second year was chosen for the administration of the test because the third- and fourth-year student do not come together as a body for formal classes, and thus, it would be very difficult, if not impossible to obtain a representative or a random sample of them (Phillips, 1971, pp. 87-88).

An additional challenge is that prospective physicians are known to work long hours focusing on issues of life or death, and, as a result, they may not be receptive to filling out questionnaires. Also a physician may feel that his or her time is too valuable to participate in survey research. Although an on-line survey may curtail many of these

problems, there are still obstacles when attempting to assess prospective physicians (refer to Chapter 5).

For the reasons described, a computer self-administered questionnaire (C-SAQ) was developed for phase II. There are several benefits of using C-SAQs among prospective physicians and recent research justified the need for using a C-SAQ in this survey. First, medical students can use computers that are located at home, campus, or any hospital at which they may be located. Second, younger adults tend to prefer computer-based surveys over traditional self-administered questionnaires (SAQs) (Johnston & Walton, 1995). In addition, researchers found that participants feel that C-SAQs are more important than traditional SAQs (Beebe, Harrison, McRae, Anderson, & Fulkerson, 1998). As a result, students were more willing to provide open-ended comments in the validation versus the pilot study. Fourth, key entry errors are decreased or eliminated by the researcher and participant, thus reducing random error. Fifth, it is more economical to develop and administer C-SAQs than traditional SAQs, because distribution and collection costs are trivial. Moreover, participants can complete C-SAQs that are visually and functionally equivalent to conventional paper and pencil questionnaires (Houston & Fiore, 1998).

Pealer (1999) determined that there were no significant differences in response rates between students taking the C-SAQ versus the traditional SAQ (Pealer, 1999). However, it was understood that medical students, unlike undergraduates, are located off campus in clinical internships and would have better access to a C-SAQ than a mailed SAQ. For this study, incentives or promotional tie-ins were not used to increase the response rate because payment could be seen as inappropriately commercializing

participation and has potential to undermine something that was of value to society (Dickert & Grady, 1999).

Procedure

A pre-notification electronic mail message was sent to students, two weeks prior to the survey, alerting them that a questionnaire would be forthcoming. Students were asked for voluntary participation during the last month of their spring semester. Two weeks later, the questionnaire was sent electronically to first- and fourth-year medical students, via the College of Medicine's web site for medical students. A cover page and consent form appeared on-line before the start of the questionnaire. It described the nature of the nutrition survey, requested cooperation of respondents, assured the privacy and confidentiality of responses, and described how the questionnaire was to be completed (refer to Appendix E). However, respondents were blind to experimental hypotheses. Medical students used their private identification code to access the questionnaire at the secured Internet site. Two separate electronic follow-up notices were sent to students to provide them with the opportunity to participate in the study. Refer to Figure 3.4 for a flow chart of the procedure.

Respondents used an all category-defined scale, which was consistent with the preliminary instrument. Attitude questions were rated on a 5-point Likert scale that ranged from "completely disagree" to "completely agree". Prospective physicians were asked to evaluate the level at which they agree or disagree with affective statements. Self-efficacy questions also were rated on a 5-point Likert scale that ranged from "very low confidence" to "very high confidence". Senior medical students were asked to judge

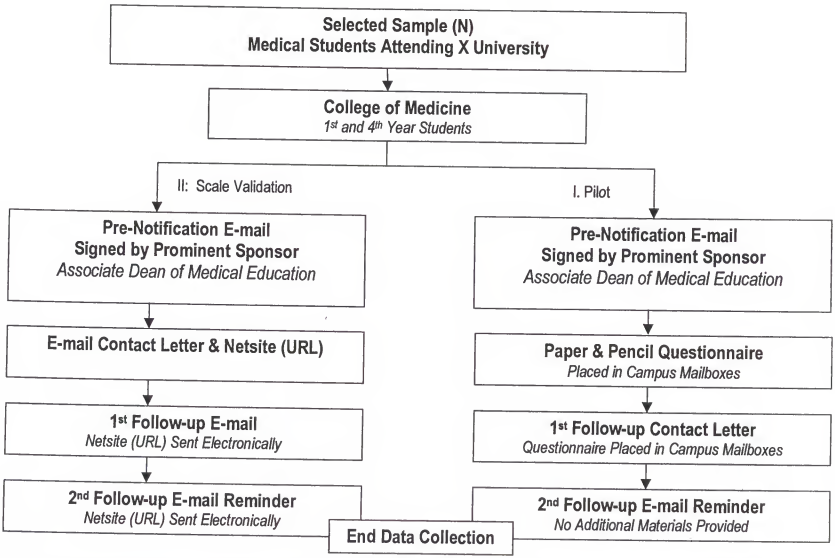


Figure 3.4. Procedure adapted for conducting web-based survey research. Source: Lisa N. Pealer, "The Feasibility of Collecting Health Behavior Data From University Students Using World Wide Web Research Technology: A Comparison of Web-Based and mailed, Self-Administered Survey Methodologies." In, Unpublished Dissertation (1999), University of Florida.

specific confidence statements. True/false/not-sure options were given for knowledge questions. A sample of the instrument is provided in Appendix F.

To improve the degree to which validity can be established, measures were compared to evaluations from an expert panel of six registered dietitians. As part of the larger study, IRB permission was granted and all experts' and responses remained anonymous. At the time of the validation study, each dietitian had 1 to 7 years experience practicing MNT, and all dietitians worked with clients that had diabetes. Each dietitian was sent a questionnaire via mail and asked to rank the difficulty of how a new physician would perceive each task (1=very difficult to 5=very easy) (Appendix G). Whereas prospective physicians rated their own level of confidence in response to each activity, dietitians provided ratings for physicians' anticipated level of difficulty of each activity. In addition, nutrition experts were asked to determine whether or not specific tasks were an important aspect of medical practice (1=yes, 2=neutral, 3=no). This enabled the researcher to assess content validity and, using the rating scale method of analysis, cross validate specific findings.

Materials

General computer writing software, such as Microsoft Word, was needed to develop and format the initial questions, scales, and expert panel review forms. Specialized web page software, created by the college of medicine, was needed to post the survey on-line and to guarantee that the web page maintained the best available secure technology. The following computer software programs was used to conduct statistical analyses: (1) Excel for importing/exporting data, (2) G*Power for assessing an

adequate sample size, (3) SPSS for running basic data analyses, and (4) FACETS for applying the Rasch model for rating scale analysis.

Operational Definition of Variables

Refer to Appendix B, "Behavioral Model for Predicting Practice Behavior" for a general schematic of independent, moderator, and dependent variables that were studied.

Independent Variables (IV)

Scores on the MNQ-D served as indicators for competency variables: (a) attitude, (b) self-efficacy, and (c) knowledge. Individual perceptions (Rosenstock, 1974b), namely attitude toward MNT, was assessed by providing participants with eleven relevant opinion statements and asking them to circle the extent to which they disagree or agree with each statement. When studying groups of prospective physicians, a researcher may classify the IV, attitude, as a population characteristic (Andersen, 1995). Enabling resources or factors (Andersen, 1995), namely self-efficacy and knowledge regarding diabetes MNT, were determined by resultant scores from the scale. Participants were given twelve items and asked to judge the extent to which they feel they are confident in their ability to do specific tasks (Bandura, 1982). To assess MNT knowledge, participants were given seventeen statements and asked to determine whether or not it is true, false, or if they are not certain. Only correct answers were included in the final score. Together, forty items represented three variables and served as a complex of skill functioning, which was expected to perform as a nutrition competency assessment for medical students.

Messick explains that researchers should be cognizant of construct underrepresentation, because this leads to invalid assessments:

> In education, whether as an objective of instruction or as a target of assessment, we are rarely concerned just with the particular performance per se but also with the knowledge, skill, and other attributes that enable both the given performance and a range of other performances engaging the same knowledge and skills (Messick, 1994, p. 16).

Messick acknowledges that an assessment can never completely capture the construct being assessed (Messick, 1994). However, he does provide recommendations to minimize construct underrepresentation (Messick, 1994). For this study, representation of competency was achieved by including constructs like knowledge and perceived skill or mastery, as well as an affective trait, namely attitude.

Nutrition education obtained in medical school, or nutrition preparation, served as an intervention and, in turn, was classified as an independent factor. Using the MNQ-D, seniors estimated the total number of hours that they learned about nutrition as a *component* of another medical school course, such as biochemistry, or at conferences, rounds, among other learning experiences. They also estimated the total number of courses that they took in medical school that had a nutrition *component*. Moreover, seniors indicated the number of *separate* nutrition courses they took in medical school, and the number of separate nutrition courses taken prior to matriculating. For this reason, "component" and "separate" nutrition courses are two mutually exclusive levels of the IV, nutrition education.

Adequacy of nutrition education in medical school was assessed globally and specifically. First, students were asked to judge the statement, "I believe that time devoted to nutrition education in medical school is", as "excessive", "appropriate", or "inadequate". They also were asked to rate the following question, using the same 5-point disagree/agree scale: "Medical school has prepared me to practice nutrition therapy".

Dependent Variable

The DV is intention, or the likelihood for a physician to engage in specific actions, namely MNT practice behavior and diabetes self-management training. This was defined by a prospective physician's intention to practice MNT. Participants were asked to estimate the percent of patients they intend on providing MNT to over the next 12 months. This observed measure was expected to change as a result of variations in specific IVs.

Moderator Variables (MV)

Secondary independent variables that was measured, and could affect the relationship between the IV and the DV, are age and gender. This is important for assessing whether or not differential item functioning occurred. Using a pop-up menu, participants were asked to provide their age as of February 1, 2000. In addition, students used a radio button to represent their gender as male or female. Because separate forms were used for first- and fourth-year medical students, students did not need to indicate their year in school. It was important to keep the data separate so that any unique group effects could be measured. In addition, current or projected specialty and undergraduate major served as MVs.

Permission, Confidentiality, and IRB Approval

Procedures for obtaining permission and protecting privacy and confidentiality were submitted to UF's-HSC, IRB, and are described as follows. Information was recorded in such a manner that the participant's information could not be identified by the principal investigator (PI), directly or through identifiers. In addition, volunteers who refused to participate in the survey maintained their anonymity, since the PI does not

have access to names of students that did not participate. Moreover, personal codes were not associated with the students' names. Student consent was provided electronically and, in turn, there was no need to maintain hard copies of a consent form. Data was maintained on a floppy disk and place in the principal investigator's locked office file for the remainder of the study. After the study was terminated, documents with identifiers that are linked to the subject (e.g., written questions to the PI) were shredded or removed promptly and appropriately. Confidentiality was maintained at all times during this study, to the extent provided by law (refer to Appendix D).

Phase III: Data Collection and Analysis

A pre-notification electronic letter was sent to first- and fourth-year students on January 18, 2000 (Appendix E). Two weeks later, the consent form and questionnaire was sent to all students. Data collection officially began February 1, 2000 and ended March 11, 2000. Students were asked to complete the questionnaire by February 28, 2000. Advanced reminders were sent on two occasions, and a final reminder was sent after the proposed deadline. The principal investigator worked closely with support personnel to insure that data was translated into a secured electronic bin appropriately. Notification of receipt of responses was sent to directly to the University's College of Medicine. Raw data was compiled by the Office of Medical Education under the supervision of Associate Dean, Dr. Lynn Romrell. In turn, it was provided to the principal investigator on diskette and prepared for analysis as a comma-delimited file.

Data Analysis

Specific correlations between variables were demonstrated to represent that the researcher was able to assess presumed constructs. External measures, such as the number

of nutrition courses taken prior to matriculating, were expected to correlate with specific variables to illustrate convergent validity. In addition, differences between and within groups on specific factors were compared to allow for assessment of the instrument under study. Reliability and bias analyses were performed. A general analysis software program, G*Power, was employed for apriori analyses. All other statistical analyses were conducted using SPSS and FACETS software. However, FACETS was used only for assessing the self-efficacy aspect of the instrument. The Rasch method of analysis was used to support validity of this scale (Wright & Masters, 1982), and followed analytical guidelines (Linacre, 1997). In this section, information relevant to the sample size and power, and analytical techniques are presented.

Sample size and power

In this measurement setting, it has been impractical to obtain a large number of graduating medical students to complete the MNQ-D. Contingencies previously described have an impact on the feasibility or workability of this study and future studies of this population. Therefore, it was critical that the investigator garnered social and material resources, and determined the minimum number of participants before the study commenced.

Power analysis. Determination of an adequate sample size is a critical factor in the design of studies, such as this, that compare alpha reliabilities (Feldt & Ankenmann, 1998). Therefore, graphical methods were used to identify a range of requisite sample sizes (Erdfelder, Faul, & Buchner, 1996; Faul & Erdfelder, 1992; Feldt & Ankenmann, 1998). For this study, interpolative power curves were used to estimate N for a statistical test given an acceptable level of power and effect size. Application of this approach

presumes that the researcher can specify a desired power for the statistical test. In turn, the acceptable threshold level for power is established at .80 and--extrapolated from the pilot study--a minimum effect size of .30 was used ($\alpha = .05$, one-tailed). Computer software was employed to determine an appropriate sample size and minimize the chances that an actual effect would not be found (type I error).

G*Power is a general power analysis program that performs statistical analyses for most statistical tests in behavioral research (Erdfelder et al., 1996). It computes power or needed samples sizes for detecting differences between independent samples (t-tests), pairs of correlations, ANOVAs (F-tests), multiple correlations and regression, and goodness of fit or chi-square tests. The program is an interactive, menu-driven program that may be used to display graphically the relations between variables and is free to researchers (URL: http://www.psychologie.uni-trier.de:8000/projects/gpower.html).

Since G*Powers had utility and was accessible, it was used a priori to determine the sample size needed for a specific power value (Figures 3.5 and 3.6). For correlational aspects of this study, the number of prospective physicians required ranged from 64 to 88, or a power of .8 to .9 respectively (one-tailed) (Cohen, 1977; Erdfelder et al., 1996). For comparing between group means, a total of 102 to 140 prospective physicians was needed ($d = .5$, $\alpha < .05$, power of .8 to .9) (Cohen, 1977).

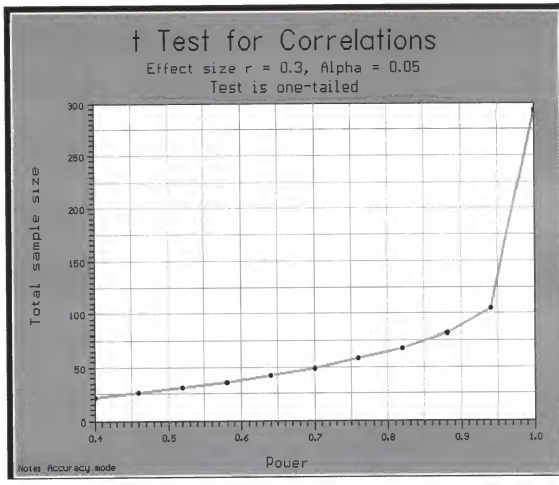


Figure 3.5. Number of prospective physicians required based on r = .3, $\alpha < .05$, and a given power level (Cohen, 1977). To minimize type I error, 64-88 participants are needed (one-tailed). Image provided by G*Power (Source: Faul, F. and Erdfelder, E., In GPOWER: A priori, post-hoc, and compromise power analyses for MS-DOS [Computer program]. Bonn, Germany: University of Bonn).

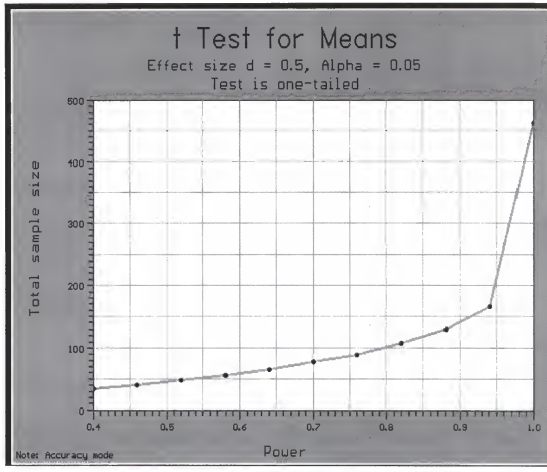


Figure 3.6. Number of prospective physicians required based on d = .5, $\alpha < .05$, and a given power level (Cohen, 1977). For 10-20% chance of not finding an effect when it is there (type I error) a required sample of 102-140 is needed (one-tailed). Image provided by G*Power (Source: Faul, F. and Erdfelder, E., In GPOWER: A priori, post-hoc, and compromise power analyses for MS-DOS [Computer program]. Bonn, Germany: University of Bonn).

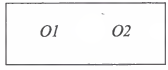
For developing questionnaires, there is an additional way to address the question, "What is an adequate number of prospective physicians for instrument development?" (Feldt & Ankenmann, 1998). For each instrument, the sample size multiplied by the number of part-tests--typically items--must exceed 1,000 (Feldt & Ankenmann, 1998). This requirement was met, for example, because each scale had minimum of 12 items and each of the two samples had a sum total of 133 participants (12 x 133 = 1,596). Feldt and Ankenmann (1998) suggest that as the number of part tests increase (over five items), the more likely it is that the researcher can control type I error (Feldt & Ankenmann, 1998).

Analytical Techniques and Tools

In this section, the methods used to analyze the data, correlations, analyses, group differences, bias or differential item functioning (DIF), and software programs, SPSS and FACETS are discussed.

Correlations

A co-relational design was used to evaluate relationships between measures.



Bivariate correlations were conducted to test the relationship between self-efficacy and the following factors: (1) level of nutrition education, (2) adequacy of nutrition education in medical school, (3) intention to practice MNT, and (4) nutrition education as a component of a medical course were conducted. In addition, attitudes toward providing MNT and knowledge were tested for their association with prior nutrition education. Pearson product-moment correlations (r) were used for continuous variables (attitude and

self-efficacy) and a point-biserial correlation were used for dichotomous data (knowledge). All directional hypotheses were be tested at alpha < .05 (one-tailed).

Factor analyses. Another set of correlationally based statistics was used to examine underlying structures among these data. One distinguishable component of validity that Messick (1995) emphasizes in his unified theory is the substantive aspect (Messick, 1995). Identifying domain processes can be assessed by applying factor analyses. In turn, common factor analyses was performed for two exemplars of affective traits, namely attitude and self-efficacy (Messick, 1995).

Group differences. T-test procedures were used to test the differences between first and fourth year medical students for attitudes, self-efficacy, and knowledge. Basic t-tests also were used to assess differences in variables for gender and age within groups. There were no main effects noted in the pilot, so there was no reason to expect that given the same level of a trait, such as self-efficacy, gender groups would have significantly different scores. In addition, previous findings do not suggest there is an interaction between gender or age and year in the program, and in turn, an interaction is not anticipated.

Using the Rasch method, it is possible to confirm the absence of mean differences, adjusted for ability, between males and females. To rule out DIF, fixed chi-square statistics should be the same for both groups (Crocker & Algina, 1986). For this study, however, differential item functioning (DIF) was assessed by using a basic t-test statistic across gender and age moderating variables. General chi-square procedures were used to test the differences between first and fourth year medical students for adequacy of nutrition education. Because few students did not choose the third category of adequacy

("excessive"), a likelihood ratio was applied. This part of the analysis used a 2 x 3 between-subject factorial design. The between-subject factors included three levels of adequacy (inadequate, adequate, and excessive).

Computer software

SPSS is a computer software program designed to conduct most types of quantitative data analyses used in the social sciences, such as bivariate correlations, t-tests, ANOVAs, factor analysis, among others. Version 9 was be used because it provides more graphic options and features that are useful for presenting descriptive statistics (SPSS, 1998).

FACETS is a computer software program designed to test specific guidelines (Linacre, 1997), and is uniquely suited to convert *qualitative* observations from rating scales (e.g., very low confidence<low confidence<medium confidence<high confidence<very high confidence) to *quantitative* linear measures in many areas of research and practice (Linacre, 1998b). Difficulty of items and persons' self-confidence, or other attributes such as attitude, ability, among others, were calibrated, or measured, on a common scale, or logit scale (Linacre, 1998b). This allows for a direct comparison to be made between the difficulty of an item and the probability that a respondent would endorse a specific value. For example, using a Likert type 5-point scale, it is expected that respondents with low self-efficacy scores are likely to report that they have "high confidence" (a value of "4" or "5") for an easy task, such as referring a patient to a dietitian. In contrast, the same group is likely to say they have "low confidence" (a value of "1" or "2") for a more difficult task, such as determining the nutrition requirements for

a patient with diabetes. Item calibrations or person measures that deviate from the population norm can be readily identified.

Aberrant items, and persons' response patterns, are indicated by outfit statistics and can be examined for inconsistencies. Persons whose measures do not match with their estimated level of self-efficacy would be flagged as misfitting. By considering the performance of one respondent, or one test item at a time, it is possible to detect guessing, carelessness, response sets, social conformity, miskeyed items, etc. Another advantage of using item response theory (IRT) with FACETS, is that IRT it is not sensitive to underlying distributions of a sample's subpopulation (Crocker & Algina, 1986). Moreover, it offers an improved method of conducting factor analysis, because rating scale data are ordinal, and hence traditional linear methods of assessment at not appropriate (Wright, 1996). Scale structure probability curves, referred to as item characteristic curves, are provided to illustrate the probability of choosing each category--such as the value "2" on a 1 to 5 point scale (Linacre, 1998b). This simple illustration indicates whether or not participants are using a full range of categories on the rating scale.

CHAPTER 4
RESULTS

The purpose of this section is to provide statistical evidence for, or against, the feasibility of developing a valid test instrument that measures nutrition competence among prospective physicians. The question, "Does the instrument measure characteristics it is interpreted to assess?" was answered by examining evidence for construct validity. Messick posits that validity issues are multi-faceted, intertwined, difficult or impossible to disentangle (Messick, 1981; Messick, 1995). As a result, a unified concept of validity with six interrelated aspects was developed (Messick, 1981). In this chapter, a summary of the statistical analyses that were conducted is presented. This is succeeded by specific analyses that follow the order of Messick's model for construct validity (Appendix H).

Overview of Analyses

Interpolative power curves were used apriori to estimate N for specific statistical tests, given an acceptable level of power and effect size. The acceptable threshold level for power was established at >.80, given a minimum effect size of .30 (α = .05, one-tailed). To minimize the chances that an actual effect would not be found (type I error), the necessary sample size was achieved. For correlational aspects of this study, the required number of medical students in each class was met. For comparing means, the estimated sample size needed for all students was exceeded.

Conventional analyses were used to assess the validity of the instrument. Bivariate correlations were conducted to test the relationship between self-efficacy and the following factors: (1) level of nutrition education, (2) adequacy of nutrition education in medical school, (3) intention to practice MNT, and (4) nutrition education as a component of a medical course. In addition, attitudes toward providing MNT were tested for their association with prior nutrition education and knowledge. Pearson product-moment correlations (r) were used for continuous variables (attitude and self-efficacy) and a point-biserial correlation were used for dichotomous data (knowledge). To enhance statistical validity, directional hypotheses were tested at alpha $< .05$ (two-tailed).

A factor analysis was used to examine underlying structures among data. In addition, t-test procedures were used to test the differences between first and fourth year medical students for attitudes, self-efficacy, and knowledge. They also were used to assess differences in variables for gender and age within groups. Moreover, the rating scale method of analysis (RSM) was used to assess the quality of the self-efficacy scale and provide evidence of validity.

Descriptive Statistics

The average score for each assessment item is listed in Appendix I. Descriptive statistics, such as the frequency, mean score, standard deviation, sample size are provided for related factors Appendix J. Tables and figures that are directly relevant to hypotheses tested are provided within the text.

Results for Statistical Validity

Analyses that support the following aspects of validity are presented: (1) content and representativeness, (2) substantive theories, (3) structure and models, (4) generalizability and (5) external convergence and discrimination (Messick, 1995) (Appendix H). However, the sixth aspect, which pertains to consequential issues (i.e., social consequences, adverse effects of testing, and problems with scoring or interpretation), was addressed in the discussion section (Messick, 1981). To preserve the organization of this chapter, hypotheses are addressed within the context of each relevant aspect of validity.

Aspect 1: Content Relevance

Content relevance and representativeness is the boundary of the construct domain that is assessed (Messick, 1995). Several methods were used to ensure that all relevant parts of the construct were covered. This was achieved by using ecological sampling, appraisal by professional judgement, and curriculum analysis.

As previously described in Chapter 2, the most recent American Diabetes Association guidelines were used as a blueprint to represent important aspects of nutrition practice. Then, experts were consulted to assess the quality of items that were constructed. In the first phase of the study, experts provided feedback on the questionnaire to ensure that the scope of the nutrition domain was represented (Appendix C). In phase II of the study, six registered dietitians appraised the extent to which each of the items was important for physicians to practice or to understand (Appendix G). A single dietitian reported that physicians' ability to perform one particular nutrition task was unimportant (Table 4.1).

Table 4.1

Dietitians' Perceptions of the Importance of Nutrition Self-Efficacy Tasks

Self Efficacy Items	Importance		
	Yes	Neutral	No
1. Refer Pts to reliable outpatient nutrition services	100%	---	---
2. Identify Pts at risk for malnutrition	100%	---	---
3. Order a nutritionally adequate diet for a newly admitted hospital Pt with type 2 diabetes	83.3%	16.7%	---
4. Provide nutrition instruction to Pts with newly diagnosed type 2 diabetes	50%	33.3%	16.7%
5. Provide nutrition information to Pts on how to achieve a desirable weight	66.7%	33.3%	---
6. Enable Pts to change their eating patterns through nutrition counseling	100%	---	---
7. Use recent nutrition-related research to improve patient care	83.3%	16.7%	---
8. Teach patients with type 2 diabetes how to determine the grams of carbohydrate, protein, & fat in each meal	83.3%	16.7%	---
9. Recommend specific diet changes based on the Pt's metabolic needs	83.3%	16.7%	---
10. Consider ethnic, cultural, & religious factors when providing nutrition instruction	66.7%	33.3%	---
11. Determine the number of calories that should come from saturated fat in a diabetic Pt's meal plan	50%	50%	---
12. Present nutrition-related case studies to colleagues at rounds, seminars, etc.	100%	---	---

Note: Six dietitians were asked to determine whether or not specific nutrition information is important in medical practice.

About two-thirds of all dietitians reported that each knowledge question was important, with the exception of question 17. Of the seventeen knowledge questions evaluated, a single dietitian rated one item (#2) as unimportant for physicians to understand. Refer to Table 4.2 for dietitians' assessment of each item.

Table 4.2

Dietitians' Perceptions of the Importance of Specific Knowledge Questions

Knowledge Items	Importance		
	Yes	Neutral	No
1. Guidelines state that type 2 diabetes can be diagnosed if fasting blood glucose is greater than 126 mg/dL	100%	---	---
2. Monounsaturated fat has fewer calories than saturated fat	50%	33.3%	16.7%
3. To control blood glucose in diabetes Pts, simple sugars should be avoided & replaced by complex carbohydrates	100%	---	---
4. Ice-cream that is labeled "sugar-free" can increase blood glucose levels	66.7%	33.3%	---
5. For Pt's with type 2 diabetes, less than 10% of their daily calories should come from saturated fats	83.3%	16.7%	---
6. Nutrition goals for type 2 diabetes Pts should include: maintenance of near-normal blood glucose, lipid, & blood pressure levels	100%	---	---
7. Weight loss of 10-20 lb can reduce hyperglycemia, triglycerides, & hypertension in Pts with type 2 diabetes	100%	---	---
8. For long-term weight loss, 250-500 calories less than the average daily requirement is recommended	50%	50%	---
9. Use of sucrose (table sugar) as part of a balanced meal plan impairs glucose control in Pts with type 2 diabetes	100%	---	---
10. A diet containing 20-35 grams of dietary fiber from a variety of food sources is recommended for most people	83.3%	---	---
11. For Pts with mild to moderate hypertension, less than 2,400 mg of sodium is recommended	66.7%	33.3%	---
12. Diabetes Pts on hemodialysis should restrict their protein intake to < .6 g of protein per kilogram of body weight	100%	---	---
13. Alcohol can be substituted for carbohydrate exchanges or carbohydrate calories	83.3%	16.7%	---
14. For diabetic Pts using insulin, 24 oz of beer or 10 oz of wine can be ingested as part of an appropriate meal plan	83.3%	16.7%	---
15. Glycated hemoglobin reflects average glycemic control over the past month	83.3%	16.7%	---
16. Dietary cholesterol should be limited to < 300 mg day for diabetes Pts	83.3%	16.7%	---
17. Vitamin and Mineral Supplementation is Advised for Most Diabetes Patients	33.3%	66.7%	---

Note: Six dietitians were asked to determine whether or not specific nutrition information is important in medical practice.

Aspect 2: Substantive Theories

Messick postulates that substantive theories and process models should be used to examine domain processes that occur in assessment tasks. A researcher can gather evidence for validity by identifying physician performances that are expected to be revealed in assessment tasks. This must be accompanied by an appropriate sampling of domain processes, and coverage of domain content. First, a principal components factor analysis was used. Second, Rasch modeling was applied to demonstrate test reliability and item fit statistics for the self-efficacy scale. Third, correlation patterns among specific scores, and bivariate correlations among presumed variables were used to assess the degree to which the substantive aspect of validity is present, or absent.

Factor analysis

Descriptive statistics showed that the majority of prospective physicians had positive attitudes toward MNT and, as expected, did not choose lower categories (i.e., response options) on the scale. The mean was 4.42 (SD=.41) for attitudes towards Medical Nutrition Therapy (MNT). In both classes, the majority of medical students reported that they had very favorable attitudes toward MNT. Unfortunately, Rasch modeling could not be performed because it is only reliable when all response options are chosen. In this case, few students chose category values less than "3" and none chose categories less than "2". Thus, a common principal component factor analysis (unrotated) was conducted to provide evidence for two major factors (Figure 4.1). Factors number 1 and 2 represent attitude and self-efficacy respectively. Moreover, eigenvalues are > 4 for each factor and represent 47.6% of the variance for first- and fourth-year students combined. As anticipated, each factor reflects similar levels of variance for each subgroup (55.0% and 44.3%).

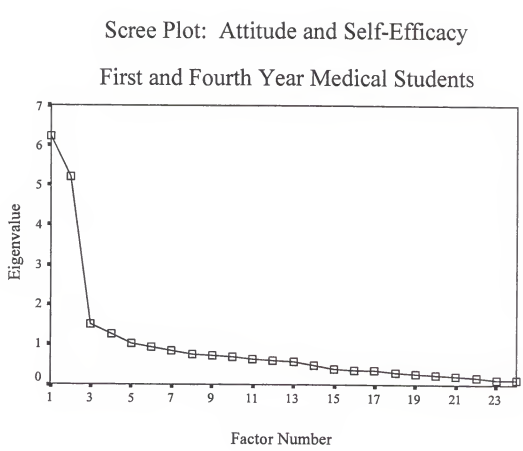


Figure 4.1. Common factor analysis for major independent variables in the Diabetes Medical Nutrition Questionnaire (MNQ-D). First- and fourth-year medical students' responses are combined.

Rating Scale Method of Analysis

Rasch modeling was applied to demonstrate test reliability and item fit statistics for the self-efficacy scale. A general analysis of the rated responses for nutrition self-efficacy questions revealed that overall category usage was unimodally distributed, with seventy-three percent of prospective physicians chose values "2" and "3" (33% and 40%). Outfit statistics, which flag unexpected observations in a category, are within an ideal range, .8 to 1.2. Table 4.3 provides an illustration of results that were used to assess quality of the self-efficacy scale.

Table 4.3

Overall MNQ-D Rating Scale Evaluation for Quality Assurance

Score Response Option	Percent (Option Chosen)	Average Measures (Higher=More Confidence)	Outfit (Norm=.8-1.2)	Step (Norm=1.4-5.0)
1=Very Low Confidence	8%	-2.39	.8	n/a
2=Low Confidence	33%	-1.21	1.1	-3.14
3=Neutral	40%	-.24	.9	-.94 (2.20)
4=High Confidence	16%	.79	1.2	1.15 (2.09)
5=Very High Confidence	4%	2.30	1.2	2.93 (1.78)

A detailed activity measurement report indicated that all items have acceptable point biserial correlations (Min. = .25, Max. = .74). Though a few items show a muted response patterns (i.e., mean square fit indices less than .8), most self-efficacy items have reasonable fit (< 2.0). There is a range of activity difficulties; the lowest value is -1.31 and the highest value is 1.42. This results in a separation index of 4.25 and reliability of .95. This means that there are statistically distinct levels of self-efficacy items and is supported by the fixed χ^2 [$\chi^2(11) = 255.2$, $p < .005$]. Activity difficulties are roughly normally distributed [random $\chi^2(10) = 11$, $p = .36$]. The activity measurement report (i.e., item measures) and responses from the expert panel are provided on the following page (Table 4.4).

As described in Chapter 3 (Phase II), panel of six dietitians were selected to rate the difficulty (1=very difficult, 2=difficult, 3=neutral, 4=easy, 5=very easy) of each questionnaire item, and determine whether or not nutrition tasks are an important aspect of medical practice (1=yes, 2=neutral, 0=no). This enabled the researcher to: (a) compare the anticipated results to what actually occurred and (b) assess content validity. Moreover, it is useful when applying the rating scale method of analysis.

Table 4.4

Activity Measurement Report for the Nutrition Self-Efficacy Scale

Item Measures (Seniors)	Mean Ratings for Dietitians (n=6)	Outfit	Point Biserial Correlations	Activity
-1.31	4.17 (Easy)	.6	.25	Refer Pts to reliable outpatient nutrition services (e.g., dietitians, diabetes educators, support groups)
-.84	3.3 (Neutral)	.9	.59	Identify Pts at risk for malnutrition
-.78	3.7 (Neutral)	.7	.61	Order a nutritionally adequate diet for a newly admitted hospital Pt with type 2 diabetes
-.65	3.00 (Neutral)	.4	.74	Provide nutrition instruction to Pts with newly diagnosed type 2 diabetes
-.43	3.12 (Neutral)	.8	61	Provide nutrition information to Pts on how to achieve a desirable weight
-.17	2.33 (Difficult)	.8	.43	Enable Pts to change their eating patterns through nutrition counseling
.32	2.17 (Difficult)	.4	.46	Use recent nutrition-related research to improve patient care
.39	1.83 (Very Difficult)	.6	.51	Teach Pts with type 2 diabetes how to determine the grams of carbohydrate, protein, & fat in each meal
.42	2.17 (Difficult)	.6	.74	Recommend specific diet changes based on the Pt's metabolic needs
.52	2.17 (Difficult)	.3	.40	Consider ethnic, cultural, & religious factors when providing nutrition instruction
1.10	2.17 (Difficult)	.9	.71	Determine the number of calories that should come from saturated fat in a diabetic Pt's meal plan
1.42	2.67 (Difficult)	.9	.61	Present nutrition-related case studies to colleagues at rounds, seminars, lectures, and other forums

Note: Item measures for prospective physicians are compared against mean ratings from dietitians for the same items. Outfit and point biserial correlations are provided for each item.

The quality assurance tables show that average measures advance (Tables 4.3 and 4.4). That is, response options with higher values reflect higher amounts of the presumed self-efficacy trait. Because all average measures increase with each higher category, there is evidence that higher response options (e.g., the value "4" or "5") correspond to more of the independent variable. To examine the degree to which validity can be established, average measures for physicians were compared to evaluations from the expert panel. The relative distribution of activity locations is consistent with what was expected (Table 4.4).

For example, activities that require advanced nutrition therapy skills (e.g., determining the number of calories that should come from saturated fat in a meal plan or presenting nutrition information to colleagues) were more difficult for prospective physicians to endorse, compared with activities that require less nutrition skills (e.g., ordering a referral for nutrition services). This is confirmed by the activity measurement report. Thus, support for construct validity was demonstrated and findings have been cross-validated.

Correlation Patterns

To ensure the researcher was measuring what was intended, particular items on the questionnaire were constructed to measure a similar trait. Thus, it was expected that there would be strong correlations for each of three factors and a related factor, or proxy variable. For instance, medical students who intended on providing *general* MNT also reported that they will provide *diabetes* MNT. This relationship was found across senior and freshmen medical students ($r = .58$, $r = .73$; $p < .01$). Intention to provide MNT should not be limited to one content area or domain of nutrition. Messick suggested that measures be generalizable to various activities in a relevant field (Messick, 1995). Thus, intention to provide *general* MNT or *diabetes* MNT should correspond to a similar dependent variable. Similarly, a student that intends on providing nutrition therapy to diabetes patients should have similar levels of intention to provide nutrition therapy to persons who are overweight, have cardiac problems, or may benefit from general prevention.

Table 4.5 shows all anticipated correlation patterns between scores. The number of nutrition hours that students take as part of another medical school course, and the total number of courses that students report as having a nutrition component are correlated ($r = .46$, $p < .01$). Moreover, the number of nutrition courses taken prior to entering medical

school is highly correlated with the total number of nutrition hours taken prior to matriculation ($r = .53$, $p < .01$). It is important to note, however, that the average number of nutrition courses taken prior to entering medical school is less than one. Over half of the senior class had not taken a single nutrition course prior to matriculation. Consequently, the variance is low thereby reducing the possibility of observing statistical relationships between factors.

Table 4.5

Correlation Patterns Among Similar Presumed Variables for Prospective Physicians.

Source	Intent to Provide General Nutrition Therapy	Courses with Nutrition Component	Nutrition Hours Prior to Matriculation
Intent to Provide MNT	—	—	—
Diabetes Nutrition Therapy	*.58***	—	—
Nutrition Hours as Part of Another Course	—	*.46***	—
Nutrition Courses Prior to Matriculation	—	—	*.53*[a]**

Note: **Correlations are significant at the 0.01 level (2-tailed). [a]Low variability. Italics denote significance in first and fourth year medical students.

Aspect 3: Structure and models

The structural aspect of construct validity requires that scoring models are reflective of task and domain structure (Messick, 1995). This means that relationships among scored aspects of performance tasks (e.g. self efficacy) should be consistent with what is known about the internal structure of the construct domain--otherwise known as structural fidelity (Messick, 1995). The Rasch method of analysis is used to demonstrate that a score model or item characteristic curve (ICC) is consistent with what is know about measures that represent self-efficacy.

Rating scale analyses demonstrate that the distance between adjacent category thresholds is ideal (1.78 to 2.20), resulting in a clear pattern of hills, portrayed by the category probability curves (Linacre, 1997) (Figure 4.2). According to Linacre (1997), the ideal distance between each step in a rating scale is between 1.4 to 5.0 logits. In the current rating scale, Facets revealed that the difference between response options is empirically meaningful (Linacre, 1997). Rating scale analysis was not appropriate for the dichotomous knowledge questions or the attitude scale. Thus, alternative methods that assess construct validity are presented.

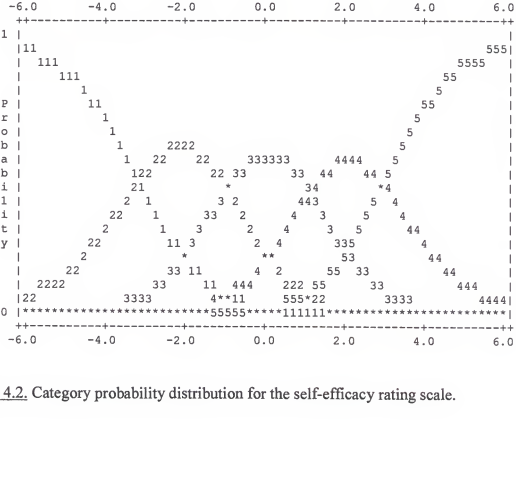


Figure 4.2. Category probability distribution for the self-efficacy rating scale.

Aspect 4: Generalizability and the External Component

Messick explains that score interpretation should be broadly generalizable to various activities in a relevant field (Messick, 1995). Score meaning is affected by the degree of generalizability across time, observers, and settings. Overall, generalizability depends on the degree of correlation of the assessed tasks with other tasks representing the construct. Thus, reliability analyses were conducted. A comparison of medical students by MCAT score showed that they were similar to students at other medical school settings. In addition, a comparison of the College of Medicine by curriculum characteristics showed that it was similar to other U.S. accredited medical schools. A more detailed explanation is provided in the methods section (Chapter 3).

Reliability

Internal consistency for each affective scale was at least .87 (Table 4.6). The overall alpha reliability for the knowledge component was .73. However, this result was not consistent across freshmen and senior medical students ($\alpha = .51$ and .81). Because

Table 4.6

Reliability for Attitude, Self-efficacy, and Knowledge of the MNQ-D as a Function of Year in School

	Alpha Reliabilities for Major Variables		
Sample & Cases	Attitude	Self-Efficacy	Knowledge
All medical students n = 133	.89	.89	.73
Fourth-year students n = 66	.88	.87	.51
First-year students n = 67	.91	.92	.81

Note. Correlation coefficients are provided for all medical students combined, and for first- and fourth-year students separately.

first- and fourth- year medical students do not have systematic training in nutrition education, it is expected that answers to knowledge questions would be variable and inconsistent between and across groups. In turn, it may not be useful to assess quality of the knowledge measures using the reliability statistic.

Aspect 5: Convergence and Discrimination

The next aspect of validity involves convergent and discriminant correlations with external variables. Its purpose is to appraise the degree to which empirical relationships with other measures are, or are not, predictably consistent with another particular measure. In addition, internal relationships between assessment scores are described. Each anticipated relationship is presented as a hypothesis and involves a criterion measure that is relevant to the evaluation. The presence of meaningful relationships between assessment scores and criterion measures are then used to support the utility of the instrument for applied purposes.

Hypothesized correlations

First, it was expected that prospective physicians' perceived level of self-efficacy for providing MNT would be positively related to the quantity of nutrition education accrued prior to matriculation. However, this relationship was not found. Prior nutrition education was not related to self-efficacy for seniors ($r = .11$, $p > .05$). This result may not be statistically meaningful due to the restricted range of responses (refer to Chapter 5). A relationship between prior nutrition education, reported as classes, and self-efficacy was only supported for the freshmen class ($r = .33$, $p < .01$). Prior nutrition training reported as hours of nutrition education was weakly related to self-efficacy ($r = .25$, $p = .057$). Bivariate correlations are provided on the following page (Table 4.7).

Table 4.7.

Multivariate Correlations for Independent (Self-efficacy, Attitude, and Knowledge) and External Variables.

Source	Self-Efficacy	Attitude	Knowledge	Component of Class		Intent to Practice		Nutrition	Prior	Prior	Elective
				Total	Hours	Diabetes	General	Adequacy	Courses[a]	Hours[a]	Nutrition
Self-Efficacy	—	-.15	.51**	.16	-.01	.17	-.01	.29*	.33**	.25	.09
Attitude	.03	—	.04	-.14	-.07	.29*	.28*	-.26*	.30*	.24	.07
Knowledge	.49**	.12	—	.10	.16	.27	.15	.16	.36**	.43**	.00
Component of Class											
Total	.09	-.21	-.06	—	.14	.11	.16	.18	.11	-.05	-.14
Hours	.21	-.24	-.08	.46**	—	.12	-.04	.20	.05	.03	.15
Intent to Practice											
Diabetes	.24	.24	.06	-.08	-.10	—	.73**	.05	.16	.20	-.18
General	.25*	.18	.14	-.04	-.14	.58**	—	-.02	.21	.22	-.24
Nutrition Adequacy	.38**	-.41**	.12	.22	.28*	-.05	.08	—	-.19	-.15	-.11
Prior Courses[a]	.11	.01	.09	.04	.25*	.19	.13	.20	—	.70**	.16
Prior Hours	.18	-.16	-.07	.13	.54**	.08	.09	.14	.53**	—	-.01
Nutrition Elective[a]	.17	-.16	-.02	.13	.39**	.09	.04	.22	.43**	.48**	—

Note: Entries above the diagonal represent freshman and entries below the diagonal represent seniors. *Pearson product-moment correlations are significant at the 0.05 level (2-tailed). **Correlations are significant at the 0.01 level (2-tailed). [a] Low variability is observed.

Second, prospective physicians' perceived self-efficacy for providing MNT was predicted as positively related to their perception of adequacy of nutrition education received in medical school. Seniors that reported nutrition education as adequate had higher self-efficacy than students that reported nutrition education as inadequate ($r = .39$, $p < .01$). Among freshmen, perceived nutrition adequacy about nutrition was also positively associated with self-efficacy ($r = .29$, $p < .05$). This provides evidence for predictive validity.

Third, it was predicted that prospective physicians' level of self-efficacy for providing MNT is positively related to intention to practice MNT. This hypothesis was supported for fourth year students, but not for freshmen. Graduating seniors who report higher levels of self-efficacy are more likely to plan on providing general MNT and diabetes MNT ($r = .25$, $r = .24$; $p \leq .05$) to patients. Whereas fourth year students estimated the number of patients they will counsel in practice, first year students estimated the number of patients they will counsel during their preceptorship. As a result, measures that represent intention among seniors and freshmen may not be comparable.

Fourth, it was expected that self-efficacy would not be associated with nutrition education that was taken as part of another medical school course. Indeed, self-efficacy was not related to the number of medical courses taken that had a nutrition *component* ($r = .09$). A weak pattern developed between the number of *hours of nutrition* education, obtained as part of traditional medical school courses, and self-efficacy; however, it was not statistically meaningful ($r = .21$, $p = .09$). Freshmen reported that nutrition education obtained as part of another medical school class (either components or hours) had no impact on self-efficacy ($r = -.01$, $r = .16$).

Fifth, it was anticipated that attitudes toward providing MNT would be positively associated with prior nutrition education. Prospective physicians' attitudes toward MNT were not related to exposure to nutrition education (classes: r = .01, hours: r = -.16). It is important to note, however, that seniors did not have varying degrees of prior nutrition education. Freshmen that had positive attitudes toward MNT were more likely to have obtained nutrition education prior to matriculation (hours: r = .30, $p < .05$).

Sixth, it was expected that knowledge would be related to the level of nutrition education obtained prior to entering medical school. No relationship between these variables was found for prior nutrition hours or classes taken among seniors. However, a highly significant relationship between prior nutrition education (hours and classes) and knowledge developed among freshmen (r = .36; r = .42, $p < .01$).

It is noteworthy that attitudes toward MNT (r = -.41, $p < .01$) are negatively associated with perceived adequacy of nutrition education, obtained across four years of medical school. That is, students that have favorable attitudes toward MNT are likely to report that nutrition education in medical school is inadequate. Another important finding was that knowledge and self-efficacy are highly correlated (r = .49, r = .51, $p < .01$) for first- and fourth-year medical students. These correlations provide evidence for convergent and discriminant validity.

Hypothesized Comparisons Between and Within Classes

Predictable differences between freshmen and senior medical students are demonstrated in this study. First, it was expected that self-efficacy would be higher among fourth year medical students (mean = 2.74) than first year medical students (mean

= 2.54) (Table 4.8). Though average scores for seniors are higher than for freshmen, the difference between classes for self-efficacy was not significant ($t = 1.74$, $p = .09$).

Table 4.8

Mean Scores for Self-efficacy, Attitudes, and Knowledge For First- and Fourth-year Medical Students

Variable	Mean	
	1st Year	4th Year
Self-Efficacy	2.54 (.72)	2.74 (.56)
Attitude	4.52 (.40)	4.42 (.41)
Knowledge	6.53 (3.71)	7.78 (2.47)

Note: Standard deviations are in parentheses.

Second, it was predicted that there would not be a difference in medical students' attitudes toward MNT across classes. The highest response option value on the rating scale was "5". Freshmen (mean = 4.52) and senior (mean = 4.42) medical students reported very positive attitudes toward nutrition therapy, and there was not significant difference between groups ($t = 1.55$, $p > .05$). Thus, attitudes toward MNT are high at the beginning of medical and remain stable over the course of medical training.

Third, nutrition knowledge was expected to be significantly higher among fourth- than first-year medical students. It was demonstrated that fourth year medical students gain some knowledge of nutrition education over the course of medical school ($t = -2.15$, $p < .05$). However, it must be noted that seniors are getting an average of one additional item correct, over the course of four years of medical training (Table 4.8).

Fourth, it was predicted that medical students' relative levels of self-efficacy and attitudes would be the same regardless of age. Neither self-efficacy nor attitudes were

associated with age for seniors or freshmen (r = -.01; r = .08). In addition, age was not correlated with the number of correct answers on the knowledge test (Table 4.9).

Table 4.9

Correlations for Self-efficacy, Attitude, and Knowledge Between Classes as a Function of Age

Variable	Age of Student	
	1st Year	4th Year
Self-Efficacy	-.01	.01
Attitude	.08	.21
Knowledge	.23	-.02

Fifth, it was hypothesized based on the pilot study results that there would not be a difference between medical students' level of self-efficacy, attitudes, and knowledge when compared by gender. There were no differences for level of nutrition self-efficacy or knowledge between males and females within classes (Table 4.10). However, there was a significant difference in attitude toward MNT between males and females for freshmen and seniors ($t = -2.29, -2.55$; $p < .05$). Females (mean = 4.53) have more positive attitudes towards nutrition therapy than males (mean = 4.27).

Table 4.10

A Comparison of Major Variables Across Classes and Gender: Mean, Standard Deviation, T-value, and Significance

Independent Variables	Means for 1st Year			Means for 4th Year		
	Males	Females	t	Males	Females	t
Self-Efficacy	2.50 (.78)	2.59 (.66)	-.46	2.74 (.63)	2.73 (.51)	.05
Attitude	4.43 (.44)	4.66 (.13)	-2.29*	4.27 (.47)	4.53 (.34)	-2.55*
Knowledge	6.5 (3.89)	6.6 (3.50)	-.09	7.65 (2.37)	7.77 (2.26)	-.17

Note. Standard deviations are in parentheses. *Differences are significant at $p < .05$.

Sixth, it was expected that perceived adequacy of nutrition education would be rated as low across first and fourth year medical students. On a 1 to 5 scale, at 68.2% of freshmen and 51.5% of seniors rated nutrition education as inadequate (< 3). The range of scores for both groups was 1 to 4, with not a single person agreeing that nutrition education in medical school is very adequate ("5"). Overall, students rated the level of adequacy of nutrition education obtained in medical school as low (senior mean = 2.2; freshmen mean = 2.3). In addition, students were asked to categorize nutrition education as inadequate, appropriate, or excessive. Eighty-three percent of seniors and 70% of freshmen reported that nutrition education was inadequate (Figure 4.3). A chi-square test indicated that there was no significant difference between males and females in the way

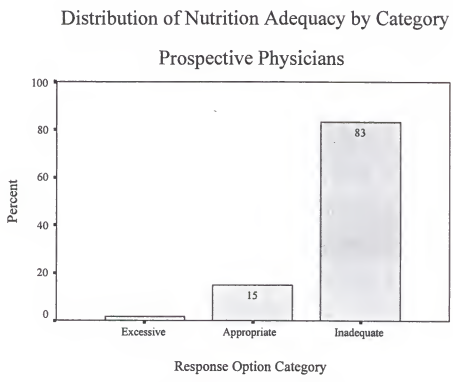


Figure 4.3. Perceived adequacy of nutrition education obtained in medical school (n=66).

that seniors responded to this question ($\chi^2 = 1.37$, df = 2, $p = .51$). Because few students reported that nutrition education was "excessive", some cells had low counts. Regardless, a likelihood ratio indicates that there was no difference between males and females for perceived adequacy of nutrition education (ratio = 1.73, df = 2, $p = .42$).

Preliminary Findings

A summary of descriptive statistics for independent, moderator, and dependent variables are presented in Table 4.11. Prospective physicians reported that their ability to perform specific MNT activities was slightly low overall. The range of scores for perceived self-efficacy was 1.5 (low confidence) to 4.8 (high confidence). The mean was 2.74 (SD=.56) and mode was 2.30. Sixty-nine percent of physicians scored between less than 3.0. Only 3.1% of physicians reported moderate or high (≥ 4.0) levels of self-efficacy (Figure 4.4).

Table 4.11

Descriptive Statistics for Independent Variables, Nutrition Education Accrued, and Intention.

	Self-Efficacy	Attitude	Knowledge	Prior Class	Prior Hours	Nutrition Elective in Med Sch.	Intention to provide General-MNT	Intention to provide D-MNT
N	65	64	54	65	63	66	66	66
Mean	2.74	4.42	7.78	.51	6.0	.24	42%	64%
Median	2.67	4.46	7.50	.00	3.0	.00	40%	60%
Mode	2.3	4.0[a]	7.0	.00	.00	.00	30%	95%
SD	.56	.41	2.47	.85	2.31	.47	2.27	3.48
Skewness	1.01	-.88	.031	1.94	3.04	1.69	.790	-.230
Range	1.5-4.8	2.8-5.0	3-13	0-4	0-13	0-2	1%-100%	1%-100%

Note: [a]. Multiple modes exist.

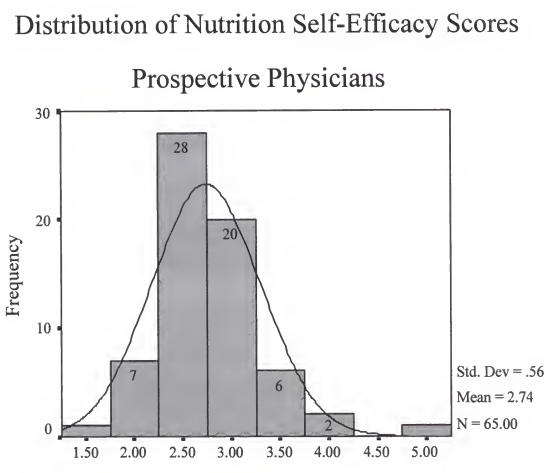


Figure 4.4. Frequency distribution of perceived self-efficacy for fourth year students.

Figure 4.5 indicates that prospective physicians generally had positive attitudes toward MNT (mean=4.42, SD=.41). The range of scores 2.8 to 5.0 with most (79.7%) endorsing positive statements toward nutrition (≥ 4.0). Of the 64 senior respondents, one reported having negative attitudes toward nutrition therapy (mean=2.8).

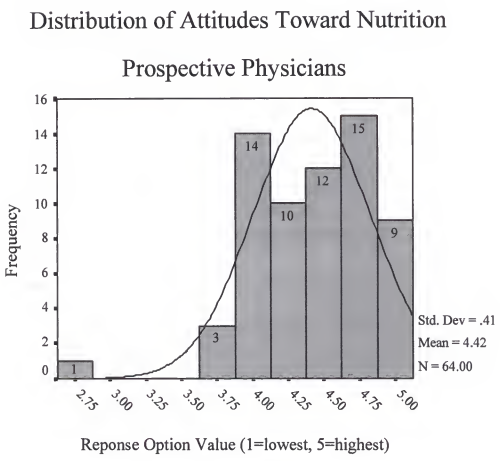


Figure 4.5. Frequency distribution of attitudes toward MNT for fourth year students.

The mean score for diabetes knowledge questions answered correctly was 7.8 or 45.9% (SD=2.47) (Figure 4.6). The highest score was 3 and the lowest score was 13 (mode=7). Only three respondents achieved a score of at least 75%, or 12 correct answers.

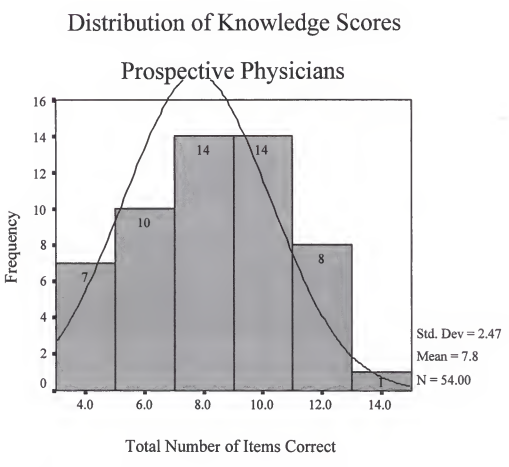


Figure 4.6. Frequency distribution of nutrition knowledge for fourth year students.

Prior Nutrition Instruction

Prospective physicians had generally obtained little nutrition instruction prior to entering medical school. Nearly all respondents (96.8%) had completed ≤ 2 classes and ≤ 25 hours of nutrition instruction. The mean number of classes taken was .5 and the mean number of hours taken was 6.0. However, most graduating seniors had not taken any courses or hours of nutrition education (mode for classes and hours=.00) prior to matriculation (Figures 4.7 and 4.8). A single senior reported having obtained at least 60 hours of nutrition instruction prior to matriculation.

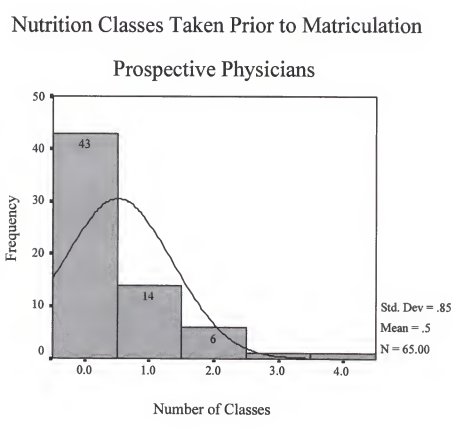


Figure 4.7. Frequency distribution for the number of nutrition classes obtained by fourth year students prior to entering medical school.

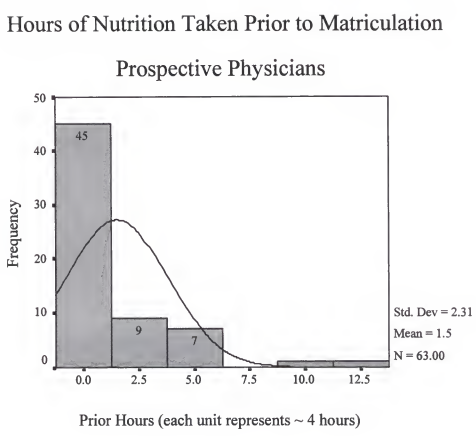


Figure 4.8. Frequency distribution for the number of nutrition hours accrued, by fourth year medical students, prior to matriculation.

Nutrition Education in Medical School

Table 4.11 indicates that the majority of fourth year medical students had not completed a nutrition course while attending medical school (mean=.24, mode=.00). Of the sixty-six respondents, a single student (1.5%) enrolled in two nutrition classes, 21.2% enrolled in one nutrition course, and 77.3% did not take any nutrition courses while attending medical school (Figures 4.9).

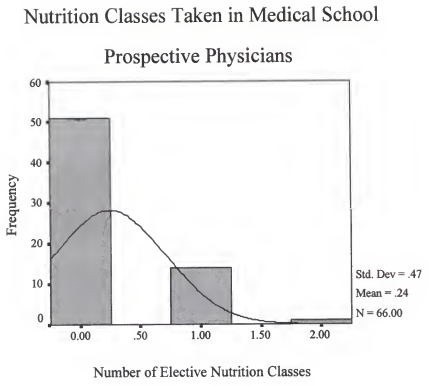


Figure 4.9. Frequency distribution for the number of nutrition classes taken in medical school, by fourth year medical students.

Behavioral Intention

Graduating medical students were asked to estimate the percent of patients for whom they intend on providing nutrition therapy over the next year. Intention to practice nutrition therapy for all patients with various conditions was lower than intention to practice nutrition therapy to patients with diabetes. Prospective physicians were asked to estimate the percent of patients for whom they would provide general MNT, or diabetes MNT, over the next 12 months. Thus, students estimated their own practice behavior as residents. Intention was lower for providing general MNT (mean = 42%) versus diabetes MNT (mean = 64%) across patients. Most seniors felt that they would provide MNT to patients with diabetes.

CHAPTER 5
SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

Summary

This chapter presents a summary of the purpose, methodologies, results, conclusions, discussion, and recommendations from the study. This study determined the feasibility of developing a method for assessing competence and intent provide diabetes MNT by prospective physicians. Theoretical constructs that have been demonstrated to predict health and practice behavior were integrated and applied (Andersen, 1995; Bandura, 1982; Green & Kreuter, 1991; Raven & Litman-Adizes, 1988; Rosenstock, 1974). This involved applying Andersen's model for health services utilization (1995), Bandura's self-efficacy theory (1982), Green's power educative approach (1991), and Rosenstock's health belief model (1974). A progressive model of construct validity was used to provide evidence for, or against, the utility of the assessment tool (Messick, 1995).

Classic test theory (Nunnally, 1994) and item response theory (Wright & Masters, 1982) were used to examine evidence for construct validity and answer the main research question, "Is it feasible to construct a valid instrument to assess prospective physicians' competence of MNT?". This involved a common factor analysis, t-tests, reliability analyses, and Rasch modeling. A correlational design was applied to examine aspects of reliability that involve internal consistency and generalizability. Descriptive statistics

were generated for both classes to provide preliminary information on the relative levels of nutrition competence, at the beginning and end of medical school.

A traditional (paper and pencil) self-administered questionnaire (SAQ) was conducted in the first phase of the study, after obtaining IRB approval and students' informed consent. An on-line computer self-administered questionnaire (C-SAQ) was administered to first- and fourth-year medical students in the second phase of the study. Three major independent variables used to assess the methodology instrument: (1) attitudes, (2) self-efficacy, and (3) knowledge. The dependent variable was intention to practice MNT. Factors, such as gender, age, and year in medical school, were considered. To examine predictive validity, several additional factors were measured, including intention to practice MNT, nutrition education accrued before and during medical school, and perceived adequacy of nutrition education. A panel of health professionals was enlisted to assess aspects of validity. In addition, these experts determined the importance and difficulty of each item on the MNQ-D.

Findings can be *generalized* to other medical school settings, and prospective physicians, with some caution. The profile of the medical school by MCAT score and curriculum characteristics suggested that students were similar to those at other traditional medical schools. However, University of Florida's (UF) College of Medicine was not comparable to schools that require nutrition education or mandate separate nutrition courses. These courses are more commonly offered within medical colleges that are affiliated with schools of public health. The defined population for the study included all first- and fourth-year medical students enrolled at the UF in March, 2000 (N=234). A total of 133 questionnaires were returned, yielding a response rate of 56.8%.

Sixty-six seniors (56.4%) and (57.3%) and freshman participated in the survey. Forty-one items were included in the validation study; this involved 12 self-efficacy, 12 attitude, and 17 knowledge questions.

Conclusions: Evidence for Construct Validity

A valid instrument was developed for assessing prospective physicians' self-efficacy, attitude, and knowledge of medical nutrition therapy (MNT). This was accomplished by providing evidence that supported major aspects of validity (e.g., content, substantive theories, structure, convergence and discrimination) for the MNQ-D. Most of the findings and the information provided by expert judges suggested that the instrument measured characteristics it was intended to assess. With one exception, every hypothesis that supports convergence and discrimination was found. Possible reasons for the latter finding are discussed in the proceeding section that addresses hypothesis testing.

Evidence for Construct Validity: Six Aspects

Content relevance and representativeness (i.e., the boundary of the construct domain that is assessed) was achieved by using ecological sampling, appraisal by professional judgement, and curriculum analysis. In general, RDs felt that physicians should have the capacity to perform specific MNT tasks. With the exception of one item, nearly all registered dietitians (RDs) agreed that knowledge and self-efficacy items were important. In the future, it may be wise to clarify or eliminate knowledge item #17, which addresses vitamin and mineral supplementation. At this writing, supplements are not regulated by the Food and Drug administration and, as a result, there is little scientific literature that addresses their utility. Consequently, RDs were ambivalent about reporting

whether physicians should be knowledgable about supplementation. Two-thirds of RDs did not state whether or not this was an important item (66.7%=neutral).

Substantive theories and models were used to examine domain processes, which occurred in assessment tasks. Evidence for validity was found because expected physician performances were demonstrated in assessment tasks. For example, the majority of prospective physicians had positive attitudes toward MNT and, as anticipated, chose higher response option values ("4" and "5") on the attitude scale. Positive attitudes toward the provision of MNT prevailed across classes. A principal components factor analysis provided additional evidence for validity. Measures that represented attitudes had a separate and unique domain from measures that represented self-efficacy. These two affective variables were established through expert judgement and confirmed through statistical analysis. In addition, Rasch modeling demonstrated test reliability for the self-efficacy scale. There were no unexpected observations and each response option represented a statistically distinct level of the attribute. As items became more difficult to endorse, participants consistently chose lower response option values. The meaning behind the results was verified by comparing item response theory statistics to subjective evaluations by an expert panel. Agreement between these methods demonstrates that findings were cross-validated.

Correlation patterns among specific scores were shown, providing further evidence for the substantive aspect of validity. Each of three factors was strongly correlated to a related factor. First, intention to provide MNT was generalizable across various types of patients. Physicians that intend to provide MNT to all patients also will intend to provide MNT to diabetes patients. Second, the amount of nutrition education obtained as part of

another medical school course was represented as hours or components (number of times courses covered nutrition material). As expected, these factors were related and closely approximated similar measures. Third, nutrition education obtained prior to entering medical school was operationalized as total hours or classes taken. It is noteworthy that most students did not take a single nutrition course prior to matriculation, thereby reducing variance and the possibility of observing a relationship to an independent variable. Regardless, these factors (classes and hours) were highly correlated with each other and, thus, measured the variable intended.

Scoring models were reflective of task and domain structure (Messick, 1995). Relationships among scored parts of competence tasks were consistent with what is known about the internal structure of the construct domain. The Rasch method of rating scale analysis demonstrated that a score model or item characteristic curve (ICC) is consistent with what is known about measures, or structures, that represent self-efficacy. The distance between adjacent response option values, such as the difference between "1" (very low confidence) and "2" (low confidence), was empirically meaningful (Linacre, 1997). Thus, a continuous interval scale was successfully constructed. The attitude scale was not subject to IRT methods because values were negatively skewed. Future scales should attempt to add or modify existing items so that the entire range of response choices is used.

Internal consistency was relatively high for each affective scale, and relatively low for the knowledge assessment. It was not expected that reliability for nutrition information obtained would be consistent across students. For example, it is possible that some students had knowledge of diabetes and nutrition from working with diabetic patients, or having friends or family with the condition. In contrast, other students may

not have been exposed to diabetes related issues. This could manifest as random or partial knowledge of nutrition and diabetes. However, a better explanation is related to the recent surge of nutrition and diabetes information that has been broadcast by the media.

A single search on the Cable News Network's (CNN's) netsite (Available: http://cnn.com/SEARCH/) for the dates May 1, 1998 to May 1, 1999, with key words "nutrition and diabetes" yielded eight major press releases. For the same time frame, May 1, 1999 to May 1, 2000, using the identical key terms, there were seventeen press releases. Media coverage of diabetes has been consistent with the rise of the disease. However, recent attention to this issue could have affected students' choices on parts of the nutrition competence assessment, because information from the media can be unreliable, incomplete, and random. This is particularly noteworthy for freshmen that are particularly adept at using on-line information sources.

When students were asked how they obtained most of their nutrition knowledge and training, most replied that it was not from education in school. Prospective physicians provided the following written comments, which indicate that nutrition knowledge obtained was unsystematic (Appendix K):

> "Most of the "published" info I have read has been in the lay press, which is often not subject to peer review (e.g., the 40-30-30 diet). However, a frustrated TPN nurse did give me a crash course one day on the wards so that I could order the proper labs and fill out the TPN form correctly . . .but she just covered in-patient TPN."
>
> "Trial and error, magazines and television, watching other physicians."
>
> "Most is hearsay and common sense. No formal training."
>
> "Here and there - no specific courses."

"School, magazines, & the web."

"Tid bits from rounds, pts, or pharmacists."

"Reading wellness magazines, some biochemistry, and some from the keeping families healthy."

"Keeping families healthy class and from pop literature and Dean Ornishes book."

An additional issue that may have affected the reliability of knowledge questions is participants' guessing at responses. Though the researcher attempted to eliminate this, by providing "don't know" options, there is still a possibility that a student could guess the correct answer to a knowledge question. In addition, nutrition education accrued among prospective physicians at UF is variable and unsystematic between and across classes. For these reasons, the degree to which test items correlated with tasks that represent the construct, knowledge was weak and inconsistent. It is not useful to assess the quality of the knowledge measures using a reliability statistic. Scales that represented affective attributes or one underlying trait (i.e., self-efficacy or attitude) were internally consistent, and results were stable across both classes and phases of the study.

The basis for construct validation is that *convergence and discrimination* with external variables was shown. Empirical relationships between measures were appraised and found to be consistent with the intended meaning of specific factors (e.g., general and diabetes MNT, and hours or classes of nutrition accrued). Hypotheses enabled the researcher to assess whether those variables that are pertinent to the evaluation demonstrated predictable correlations or the lack thereof. Not all anticipated external relationships were demonstrated in expected directions. However, the relevance of relationships between evaluation scores and criterion measures were verified for most factors.

Hypothesis testing

Each of six hypotheses was tested to examine relationships between independent variables and related factors and was used to assess evidence of validity. Convergent validity was demonstrated by evaluating whether self-efficacy was related to nutrition preparation and intention to provide MNT. Prospective physicians who reported high levels of nutrition self-efficacy did not necessarily have nutrition training prior to entering medical school. The *first hypothesis* was tested and results indicate that was no significant relationship between prior hours of nutrition training and self-efficacy. However, a directional trend developed for seniors ($r = .25$, $p = .06$), and for freshman, self-efficacy was significantly associated with higher levels of nutrition education accrued prior to matriculation. One can speculate that first year medical students are able to recall the amount of nutrition education obtained prior to matriculation with more accuracy than fourth year medical students. In both classes, however, there was concern that variance was low because most medical school applicants are not required to take nutrition courses. Nearly all respondents (96.8%) had completed ≤ 2 classes and ≤ 25 hours of nutrition instruction. The mean number of classes taken was .5 and the mean number of hours taken was 6.0. However, most graduating seniors had not taken any courses or hours of nutrition education (mode for classes and hours=.00) prior to matriculation. A single senior reported having obtained at least 60 hours of nutrition instruction prior to matriculation (Figure 4.9).

Findings that involve level of prior nutrition education obtained may not be statistically meaningful due to the restricted range of responses. In this case, the presence of outliers significantly impacted the results. For example, one prospective physician

reported that he did not have a single hour of nutrition education prior to matriculation. Yet, his overall self-efficacy score was high (4.8) compared to other students. A second student reported that she had about 3 hours of nutrition instruction prior to entering medical school, yet her overall self-efficacy score was high (4.2). This is consistent with one of the written comments by a graduating medical student, who expected that some students would overestimate their expertise regarding nutrition:

> I expect that many respondents will overestimate their knowledge [expertise] and underestimate the need for curricular changes. Furthermore, most students and physicians are unaware that the US Health and Preventive Services (Healthy People 2010) has issued a goal that all clinicians counsel their patients about physical activity and nutrition, and most medical educators are completely oblivious to the relevance and importance of these topics (Graduating Senior, Class of 2000, Appendix K).

When outliers were removed the findings became consistent with what the researcher had anticipated, self-efficacy is related to the amount of nutrition instruction obtained prior to entering medical school ($r = .29$, $p = .028$). This suggests evidence for convergent validity (Figure 5.1).

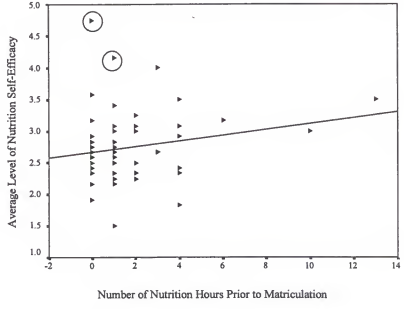


Figure 5.1. Scatter plot of nutrition self-efficacy and number of nutrition hours obtained prior to matriculation, among prospective physicians. Outliers are circled.

For the *second hypothesis*, prospective physicians' perceived self-efficacy for providing MNT was expected to be positively related to their perception about the adequacy of nutrition education received in medical school. Indeed, seniors who believed that nutrition education was adequate had higher self-efficacy than students who felt that nutrition education was inadequate. The same effect was found for freshman. An incidental finding showed that general attitude toward MNT is negatively associated with perceived adequacy of nutrition education, across classes. That is, students who have favorable attitudes toward MNT are probably more critical about low status of nutrition education in medical school and, thus, report that it is inadequate. These findings provide substantial evidence for predictive validity and have implications for evaluating students' perceptions of the quality of their medical school education.

Third, it was predicted that prospective physicians' level of self-efficacy for providing MNT would be positively related to intention to practice MNT. Only graduating seniors who report higher levels of self-efficacy were more likely to plan on providing general MNT and diabetes MNT to clients. Whereas fourth year students are likely to estimate the number of patients they will counsel in practice, first year students are likely to estimate the number of patients they will counsel during their preceptorship. Therefore, measures that represent intention among seniors and freshmen are not equivalent.

Fourth, it was expected that self-efficacy would not be associated with nutrition education that was taken as part of another medical school course. Self-efficacy was not related to the number of medical courses taken that had a nutrition *component*. A trend started to develop between the number of *hours of nutrition education*, obtained as part of

traditional medical school courses, and self-efficacy; however, it was not significant ($r = .21$, $p = .09$). For freshman, nutrition education obtained as part of another medical school class (as components or hours) did not have any impact on self-efficacy. This is consistent with a study which found that knowledge between freshman and seniors was not affected by integrated teaching of nutrition (Cohen, Hunsley, Wattler, Karsten, & Olson, 1981). However, a required nutrition course resulted in significantly better test scores. This study verifies that medical students would benefit from a separate nutrition course (Cohen et al., 1981; Frankle, Williams, & Christakis, 1972; Winick, 1984), and supports the conclusion by Myron Winick, M.D.:

> There are two kinds of integrated approaches to nutrition education in medical schools. One, the kind of integrated approach Dr. Rombeau presents, in which there are required courses early and then elective courses in the second, third, and fourth years. The other type of an integrated approach attempts to integrate the subject of nutrition within the existing course structure…I favor the first approach, am strongly against the second approach, which scatters nutrition throughout other courses…experience has shown that this second approach does not work (Winick, 1984, p. 610).

Fifth, it was anticipated that attitudes toward providing MNT would be positively associated with prior nutrition education. There was no relationship between prospective physicians' attitudes toward MNT and exposure to nutrition education. For freshmen, however, attitudes were related to the amount of nutrition education accrued before medical school. It is unclear whether students with positive attitudes toward MNT seek out nutrition education, or if students that participate in nutrition education are more likely to develop a positive attitude toward MNT.

Sixth, it was expected that knowledge would be related to the level of nutrition education obtained prior to entering medical school. Knowledge was not related to prior nutrition education obtained for seniors, but it was significant for freshman. Again, these

opposing statistics may have resulted from a range restriction, which makes it difficult to show correlations between a presumed factor and prior nutrition education--in both classes. Another incidental finding showed that knowledge and self-efficacy are highly correlated for first- and fourth-year medical students. This confirms that low self-efficacy (or the ability to perform specific tasks) emerges when nutrition competence is low, which is probably not related to perceptions of general self-confidence or psychological issues (Green, 1999). Overall, these correlations provide evidence for convergent and discriminant validity.

Comparisons. Each of five hypotheses specified was tested to examine differences between independent variables and related factors. *First,* differences between freshman medical students and their graduating senior counterparts were demonstrated. It was expected that self-efficacy would be higher among fourth year medical students, who have had more training than first year medical students. Though the difference between classes showed a weak difference, using a two-tailed test ($t = 1.74$, $p = .09$), it may still prove to be an important effect. It is not evident, however, that self-efficacy improves as a result of nutrition hours obtained as part of another medical school course or maturation. Fourth year medical students gain some knowledge of nutrition education over the course of medical school, and this may affect self-efficacy. However, the amount of knowledge gained over the course of medical school appears to be negligible--that is, only one additional item was correctly identified.

Second, medical students' attitudes toward nutrition therapy were the same across classes. Both classes demonstrated high and positive attitudes towards MNT. When seniors were asked to rate the extent to which they agreed ("5") or disagreed ("1") with

the specific attitude statements, they strongly agreed that, "Nutrition therapy is an essential component of successful type 2 diabetes management" (mean=4.9, mode=5) (Appendix I). There were no significant differences between men and women for this particular item ($t = 1.61$, $p = .12$).

Third, there were no differences for level of nutrition self-efficacy or knowledge between males and females within each class. However, there was a significant difference in global attitude toward nutrition between genders. When all assessment items were combined, females had more positive attitudes toward nutrition therapy than males. This result was not significant in the pilot study, however, it is consistent with related literature (Hollis, Carmody, Connor, Fey, & Matarazzo, 1986; Liang, Shediac-Rizkallah, Celentano, & Rohde, 1999; Verbrugge, 1985). It is noteworthy that when students were asked how they are going to learn about nutrition after they graduate, one female student wrote, "On my own (via concern about my own health)". Another women commented that, "Residency training will provide some formal education, however, I'm afraid that much knowledge will be picked up piecemeal. Frankly, I've learned more about general nutrition from educating myself to be a good parent than I have learned in Med school"(Appendix K).

In 1986, relationships among attitudinal factors and dietary habits were examined. Researchers found that there was greater involvement by women in food selection and preparation, leading to more awareness of the role of diet in health (Hollis et al., 1986). More recently, the Behavioral Risk Factor Surveillance System (n=4455) was used to assess differences between males and females for specific health behaviors. Women were found to engage more frequently in health behaviors and seek health information than men

(Liang et al., 1999). Researchers have attributed these findings to social role differentiation (Liang et al., 1999; Verbrugge, 1985). Still, little is known about how gender differences may impact attitudinal factors and nutrition promoting activities among practitioners.

Fourth, it was expected that medical students' relative levels of self-efficacy and attitudes would be the same. Neither self-efficacy nor attitudes were associated with age for both classes, thus, it was not necessary to adjust for this factor. For prospective physicians, age was not significantly correlated with the number of correct answers on a nutrition knowledge test. Among freshman, however, there was a weak pattern developing between knowledge and age ($r = .23$, $p = .08$, two-tailed).

Fifth, it was expected that the majority of students would report that nutrition training was not sufficient. Over half of all freshmen and seniors agreed that medical school has not prepared them to practice nutrition therapy. This finding was verified by asking students to categorize nutrition education as inadequate, appropriate, or excessive. Regardless of gender, over two-thirds of both classes reported that nutrition education was inadequate.

As expressed by one respondent:

> . . . over and over in lectures, we heard attendings say, "And of course when a patient has condition X you'd need to discuss diet with them", but there would be no specifics on what "discuss diet" meant. I'd like to know specific recommendations for weight loss, hypercholesterolemia and heart disease, diabetes, hypertension, malnutrition, and pregnancy…our training in nutrition is woefully inadequate. . . (Graduating Senior, Class of 2000, Appendix K).

The data indicate that nutrition knowledge and self-efficacy of prospective physicians who received little or no formal training in nutrition is wholly inadequate if they are expected to offer diabetes MNT. This is of concern because the participants in

this study have now graduated and are continuing their specialized training as medical residents. Physicians' ability to perform specific MNT activities was generally low, with over 90% of them reporting less than average nutrition self-efficacy. Overall, physicians generally reported very positive attitudes toward MNT (≥ 4.0). Although physicians believe that nutrition is an essential component of diabetes management, they do not feel capable of providing the treatment for this epidemic.

The relatively low level of knowledge regarding diabetes management could have moderated levels of self-efficacy. The average score on the diabetes knowledge test was slightly less than 50%. Only one-third of physicians were able to correctly identify an important guideline from the American Diabetes Association: "For patients with type 2 diabetes, less than 10% of their daily calories should come from saturated fats". In addition, less than half of the physicians knew that glycosylated hemoglobin is the main laboratory indicator for assessing glycemic control (i.e., blood sugar) over the course of several weeks (Appendix I).

These knowledge deficiencies are consistent with other findings, which suggested that physicians had little formal nutrition training prior to, or during, medical school. On average, fourth year students had taken .5 classes, or 4 hours, of nutrition education prior to matriculation. Three percent of seniors and 9% of freshman enrolled in more than 2 nutrition courses prior to entering medical school. This finding reflects the number of students that majored in nutrition as undergraduate students. Three freshmen and one senior were nutrition majors. Thus, the number of classes and hours taken were more varied in the freshmen (range = 0 to 200 hr) versus the senior class (range = 0 to 60 hr). Had there been a wider range of scores among seniors, all predicted relationships that

relied on this factor might have emerged. For example, the relationship between prior nutrition education, reported as classes, and self-efficacy was only supported for the freshman class.

Discussion

In a survey of evaluation instruments used by clerkships in U.S. medical schools, it was determined that, "Measures of clinical evaluation have not predicted physician performance, partly because few clinical performance instruments are either reliable or valid. . ." (Peid, 1974, p. 12). Twenty-five years after this paper was published, there continued to be a dearth of assessment tools to monitor nutrition competence among prospective physicians. The purpose of this study was to create a valid instrument that is theoretically sound and has potential to predict practice behavior. In this instance, the instrument sought to measure intent to practice MNT and thus impact the treatment of diabetes.

An instrument for measuring nutrition competence constructed successfully. Evidence for validity was established by examining its six aspects, and testing relevant hypotheses for convergence or discrimination. Hence, there was confirmatory evidence for the convergent aspect of validity. Evaluating the degree to which empirical relationships were consistent with other measures further substantiated the meaning of scores. Appraisal by nutrition experts, as to the importance, difficulty, and meaning of each item was uncovered. Power analyses indicated that the study was sensitive to the effects measured, although power could be improved to .9 in follow-up studies. Finally, some preliminary findings with regard to relative levels of nutrition adequacy, attitudes,

self-efficacy, and knowledge among a group of prospective physicians could be presented.

Consequential Aspect of Validity

Although the evidence for validity attests to the utility of scores for applied purposes, it is important to describe how this instrument should be used and its limitations. This begins to address the sixth, and final aspect of validity, which involves justifying the development and application of the instrument (Messick, 1981). Interpretation of competence scores, and dissemination of the findings, may have intended and unintended consequences. Social consequences of using this instrument and issues pertaining to test invalidity are addressed (Messick, 1994; Messick, 1995).

Uses and limitations

First, the particular collection of items for the questionnaire may not generalize to other aspects of nutrition therapy. Though specific items do apply to other domains in nutrition, this instrument was to be used for assessing competence of *diabetes* MNT. Thus, it mainly relates to physicians' perceived ability to initiate or practice *diabetes* MNT with patients. Additional work will be needed to develop *general* measures of nutrition competence among prospective physicians.

A second limitation to this study is the small number of participating physicians, from one particular college of medicine. Though the site had similar characteristics to most U.S. accredited medical schools, it would be desirable to obtain a larger number of people to participate in the survey. This way, a random sample of schools and students could be selected. Cluster sampling with a nested design would be ideal. However, it is difficult to obtain a large number of medical students to complete a questionnaire. As

previously described, prospective physicians work at various medical centers during their clinical years and can be difficult to locate. For example, a similar study of medical students (n=874,853) used a self-administered questionnaire and yielded a response rate of 48% for freshmen and 28% for seniors (Morgan et al., 1988). Thus, an on-line questionnaire was expected to be the best method for administration.

Third, an additional challenge is that physicians are known to work long hours, often focusing on life threatening conditions, and may not be receptive to filling out a questionnaire. As a result, those that do participate in the survey may be more interested in nutrition and, thus, have more positive attitudes towards MNT. Self-selection can be problematic for survey research (Fowler, 1995). Random selection and a comparison group can be useful. However, this comes with a higher expense and challenge of garnering the support of multiple medical school stakeholders, which can render the study difficult to implement.

Fourth, it is critical that the investigator is able to garner social and material resources before the study commences. Access to prospective physicians requires the approval and support of key leaders in medical education. The UF Associate Dean of Medical Education was instrumental in facilitating this research. Without this form of support this research would likely be much less possible.

Fifth, respondents were a relatively homogeneous group of graduates. This affected the type of analysis that was performed. For example, the rating scale method (RSM) of analysis was only useful for self-efficacy items, because attitudes were all negatively skewed. A more diverse sample of participants, and items, would allow the researcher to subject the scale to RSM.

Sixth, self-reports are not robust to features of the research instrument. Though this researcher took several precautions to prevent unique response sets or random error, it is important to note that researchers, in general, may not be fully aware of the information that questionnaires provide (Schwarz, 1999). The extent to which items influence the way that questions are answered is not known (Schwarz, 1999). Self-reports are a fallible source of data, and minor alterations in item working, format, or scale can result in major changes in the results. For example, Schwartz (1999) describes a study in which participants were asked how successful they were in life. He found that 34% reported high success, however, when the scale was modified, from a bipolar (i.e., -5 to 5) to a unipolar (i.e., 1 to 10) scale, only 13% reported high success (Schwarz, 1999).

Adverse consequences

Competence assessments in medical education have possible benefits of improving curricula and nutrition training programs. However, Messick states that it is important to accumulate evidence of such positive consequences as well as evidence that negative consequences are minimal (Messick, 1994; Messick, 1995). It could be argued that if we assess nutrition competence among physicians, and it is low, that dissemination of the results could cause people to lose confidence in their physicians' ability to provide treatment. In turn, people might seek out health services from unqualified nutritionists. For example, a patient may decide to self-medicate with nutritional supplements rather than ask an uninformed physician about methods for weight loss. However, there may be large gains for the public if policymakers became aware of the discrepancies in physician nutrition education and attempted to remedy this problem.

Another concern is that physicians who participate in this type of survey may become more aware of the importance of nutrition and patient outcomes. However, if physicians feel that they are not skilled at providing MNT, or coordinating care, they will not feel accountable for nutrition related problems in their patients. Rather than take responsibility for neglecting the nutrition status of a patient, a physician could blame the patient for careless eating habits. The study investigator has observed hospital physicians become frustrated with patients who are obese, because physicians have learned that overweight contributes to complex medical conditions and expensive treatment. This can easily lead physicians to develop antagonistic relationships with patients that are obese or have difficulty following nutrition protocols. However, if physicians become more aware of the importance of nutrition and understand that they need more training in the field, they can become advocates for improving the state of nutrition training. Hochbaum recognizes this issue as it pertains to persons adopting sound nutrition habits, but an analogy could be made to physicians who improve their nutrition practice behavior:

> One can say that ignorance, misconception, indifference, and other cognitive and affective factors are risk factors which reduce the probability that a person will adopt sound nutritional habits (Hochbaum, 1981, p. s64).

If our medical authorities fail in discussing nutrition with their patients, poor doctor-patient partnerships resulting from lack of nutrition competence could be viewed as risk factors that contribute to poor treatment outcomes. Thus, assessment of nutrition competence, followed by changes in medical curricula, could improve competence and practice behavior for practitioners. However, if patients are going to be the ultimate recipients of changes in medical curricula, then scientists must reconsider when and how

physicians should intervene in peoples' lives (Hochbaum, 1981). Persuasion, pressure, or coercion are not sound health education practices, thus physicians must consider the most appropriate methods to induce people to modify dietary practices they enjoy (Hochbaum, 1981; Raven & Litman-Adizes, 1988). It recommended that physicians be, at minimum, trained to refer clients to qualified professionals for in-depth MNT. In addition, they must understand that MNT is a relatively new field. Thus, practices that are adopted in light of future findings may yield a range of benefits.

However, before gathering preliminary finding about nutrition competence among physicians, it is essential that the quality of evidence for validity be demonstrated. The results from this study should not only be used to point out that nutrition competence should be improved among physicians. It should also compel medical educators and policymakers toward diagnosis for remedial action (Messick, 1981).

Sources of invalidity. A researcher must guarantee that adverse consequences for participants in the study should not be a result of test invalidity (Messick, 1994). For example, low scores should be a result of missing elements that are related to the construct. If missing elements prevent persons from displaying their competence, than the assessment tool under-represents the construct and is invalid. Thus, clear and specific instructions were given at the beginning of the survey. To guarantee that all participants were defining nutrition therapy in the same way, they were told that it refers to the provision of diet related orders, instructions, counseling, advice, referral or consultation, screening, and assessment. Low scores should not occur because the assessment contained irrelevant factors that interfered with the participants' test performance (Messick, 1994). The researcher limited the questions only to those that

would assist with assessing validity and hypothesis testing, thus only relevant information was requested. One problem which relates to test-item irrelevance is that the testing environment was not well controlled. It is entirely possible that some physicians answered the questionnaire from a computer terminal in a hospital--which may have been distracting for some. However, because there were several obstacles when trying to locate and access medical interns (refer to Chapter 3), the on-line questionnaire was very useful. Computer based surveys can be disseminated with relative ease and can be extended to the unique needs of the study participants or medical school setting.

Despite the fact that most of the physicians were busy participating in internships, nearly all respondents were willing to provide additional written feedback. In addition, nearly all written feedback was positive. A sample of comments that represent physicians' reaction to the questionnaire are provided. All statements, in their entirety, are provided in Appendix K. It is noteworthy that not a single medical school graduate expressed a negative response to the survey.

> "This survey is very well structured. I have heard much discussion over the years about increasing the amount of nutrition education we receive, and we are constantly reminded of its importance. I hope that this study will make that education a reality to future students."
>
> "I wish I felt more confident in my responses to the questions."
>
> "The best way to help doctors place more emphasis on nutrition is to cover it better during the preclinical years and to give students a reliable source to consult later. Best of luck with your survey."
>
> "Not bad at all."

Recommendations

Research has documented sufficient nutrition information to enable physicians to provide, or coordinate, MNT. Improved nutrition competence should come from accumulated scientific evidence, nutrition surveys, epidemiological studies, cost-effectiveness studies, and the application of this information into nutrition courses and training during residency. By providing prospective physicians with the information and skills that they need for MNT, practice behavior may be improved. Still, many questions about the potential impact that nutrition in medical education may have on the health of the public remain.

Future Evaluation Studies

Evaluations of nutrition training programs have tended to measure only short-term changes in knowledge, or cognitive aspects of learning. Periodic reassessment is required to enhance the opportunity for improving the status of nutrition education in medical curricula. Long-term evaluations could be invaluable, but there are few valid assessments, which capture affective aspects of learning that impact behavior change, and evaluations can be costly (Council on Scientific Affairs, 1990). Thus, the real success of nutrition education in undergraduate and graduate medical curricula has not been evaluated. This has impeded our understanding of the connection between medical training, practitioner behavior, health promoting activities, and the health of the public. Future studies should examine:

1. How nutrition monitoring should be conducted at U.S. medical schools;
2. How results from curricula evaluations can be used to improve physician education;

3. Whether or not practitioner intention translates to nutrition practice behavior;
4. How specific variables such as , nutrition self-efficacy, attitudes, and knowledge modify practice behavior;
5. How the sociopolitical environment impacts physician nutrition practice behavior;
6. Physician nutrition practice behavior and the impact on patient outcomes;
7. How gender plays a role in nutrition practice behavior ;
8. How to recruit medical students that have expertise or formal training in nutrition education;
9. How to recruit and retain, accessible nutrition mentors that can be available to students and faculty;
10. How to cultivate more partnerships between colleges of medicine, schools of public health, and departments of food science and human nutrition;
11. The model can be used to identify strategies for increasing physician adherence to MNT, and disease prevention, protocols.

Suggested Goals for Nutrition Education

On the basis of the results from this study, including the qualitative statements provided by participants, there is a need for nutrition training in schools of medicine. To achieve nutrition literacy, medical educators must develop methods to teach medical students:

1. Why nutrition is important in health promotion, disease prevention, and lifestyle maintenance;
2. How to identify and prioritize nutrition problems through screening and assessment;

3. Where to obtain accurate information for clinical problem-solving or patient referral;
4. To whom they should be providing MNT and when to refer;
5. How to use recent nutrition-related research to improve patient care and cost-effective therapies;
6. How to become a positive role model and/or faculty mentor.

In addition, this survey should be used to address the gap between knowledge and practice among prospective physicians. Although the American Medical Student Association formed recently agreed on 92 topic areas for nutrition education in medical curricula (American Medical Student Association, 1996), specific topic areas requested by graduating medical students are provided (Figure 5.2). A verbatim transcript is provided in Appendix K.

Concluding Remarks

Findings from this study verified that a theoretically driven, valid and reliable instrument was created to assess prospective physicians' relative levels of competence for diabetes MNT. The researcher achieved the goals of this study, which were to: (1) describe the development of a nutrition education assessment instrument (MNQ-D), (2) discuss how social cognitive theory and behavioral models are applied in this study, (3) evaluate the reliability and validity of MNQ-D using classical test theory and item response theory, (4) describe how this tool should be used for future outcomes research, and (5) explore relative levels of nutrition self-efficacy, attitudes, and knowledge among graduating medical students at one U.S. accredited medical college.

1. MNT Content Areas

- Diabetes and related issues (e.g., carbohydrate counting, exchanges, and the ADA diet)
- Hyperlipidemia
- Hypertension
- Liver disease failure
- Malnutrition
- Overweight and obesity
- Pediatric nutrition
- Renal disease & dialysis
- Total parenteral nutrition (TPN)
- Drug-nutrient interactions

2. Behavior Modification

- Components of a balanced diet
- Dietary guidelines for hospitalized patients
- Healthy habits
- Weight management, non-pharmaceutical methods

3. Nutrition Screening & Assessment

- Nutrition requirements and basal metabolic needs
- Nutrition calculations

4. Nutrition Counseling

- Counseling patient on nutrition
- Cultural influences on diet
- Interpreting nutrition information from labels

5. Current Topics & Research

- Diet trends (e.g., the Atkins diet, use of omega fatty acids, garlic, soy, Mediterranean diet, anti-oxidants, and over the counter diet products)
- Vitamins as nutritional supplements
- Scientific research in nutrition

Figure 5.2. Specific topics in nutrition that were requested by graduating medical students. Five major categories were identified.

While the importance of nutrition education in medical practice is well established, primary care physicians have not been enabled to screen, monitor, or provide follow-up to patients with diabetes (Glanz & Gilboy, 1992; Lawler & Viviani, 1997). Federal strategies to encourage and promote sufficient nutrition education for medical students can only be achieved if curricula are modified and accountability studies are conducted. Almost twenty years ago, Sims stated:

> Only by facing evaluation and learning from it (rather than avoiding it) will we be truly able to say that we have accomplished much in the name of nutrition education! (Sims, 1981, p. s74).

By creating instruments and using practical technology to assess nutrition literacy in medical schools, nutrition training among medical students can be improved (Schulman, 1999). For example, it has become clear that the basic foundations of diabetes nutrition are not necessarily learned when they are presented as part of another medical school course. One graduate reported that, without a schema, it is difficult to learn and retain nutrition information:

> One thing I have come to realize is that nutrition is rather complex and factual. It is difficult to retain these facts. It is probably more beneficial to teach medical students the basics of nutrition and then how to obtain appropriate consultation from skilled nutritionists for more complex issues (Graduating Senior, Class of 2000, Appendix K).

Prospective physicians who have taken a nutrition course even in the absence of further nutrition training will, as physicians, be more sensitive to the implications of adherence to dietary protocols, than practitioners who have not been exposed to nutrition education (Frankle et al., 1972). In addition, they would be more appreciative of the skills of nutrition experts who have been trained to provide MNT. This addresses some of the concerns that relate to the sixth, or consequential, aspect of validity.

Appropriate use of valid instruments can prepare scientists to: (1) identify factors that limit the ability of practitioners to provide MNT, (2) gain a broader understanding of dietary adherence, (3) improve their understanding of nutrition behavior, and (4) build on theoretically based models that recognize the powerful role of the physician. Furthermore, information learned through sound assessment techniques has potential to inform curricular decisions, assist health promotion and disease prevention efforts, reduce health care costs, and improve the quality of life those persons and their caregivers who are surviving with diabetes. On the basis of this study, it is recommended that teaching and evaluation of nutrition in medical schools as it relates to MNT must be strengthened.

APPENDIX A
GUIDELINES FOR DIABETES MEDICAL NUTRITION THERAPY

MNT can be achieved by enabling a patient to adhere to the following nutrition guidelines (American Diabetes Association, 1999).

Moderate calorie restriction of 250-500 calories less than an individual's daily average intake (determined by dietary recalls, food frequency questionnaires, etc.)

Moderate weight loss of 5-9 lb, irrespective of starting weight, can reduce hyperglycemia and blood lipid levels

Spacing of meals or spreading nutrient intake, particularly carbohydrate, throughout the day

Protein intake should contribute about 10-20% of daily calories per day; with the onset of nephropathy, lower intakes of protein should be considered (0.8-0.6 g/kg/day)

Total fat intake should be limited to < 30% of calories, with saturated fat restricted to 10% of calories, polyunsaturated fat <10% of calories, and monounsaturated fat in the range of 10-15% of calories

Dietary cholesterol should be limited to ≤ 300 mg daily, but must be incorporated with consideration of an individual's cultural and ethnic background

Carbohydrate is individualized and based on the person's eating habits, glucose, and lipid goals; there is little scientific evidence to support the belief that simple sugars should be avoided and replaced with starches because they are more rapidly digested than starches; priority should be given to the total amount of carbohydrate consumed, versus the source of carbohydrate

Sucrose, or sugar, as part of the total carbohydrate content of the diet does not impair BG control; sucrose-containing foods must be substituted for other carbohydrates.

Fructose may be used in moderation and must also be accounted for as dietary carbohydrate

Other nutritive sweeteners (e.g. corn syrup, fruit juice, honey, dextrose, and sugar alcohols) must be accounted for in the mean plan and have potential to affect BG levels

Nonnutritive sweeteners (e.g. saccharin, aspartame, acesulfame K, and sucralose) can be safely consumed on a daily basis; intake by individuals is typically below the Food and Drug Administrations acceptable daily intake (ADI).

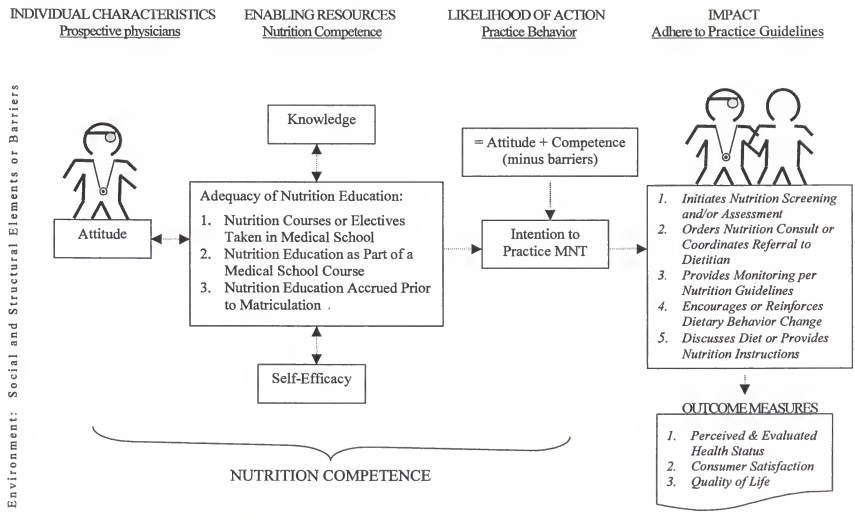
Fiber recommendations is the same as for the general population, 20-35 g dietary fiber from both soluble and insoluble fibers

Sodium recommendations are the same as for the general population, 3,000 mg/day; some authorities recommend no more than ≤ 2,400 mg/day for people with moderate HTN, and ≤ 2,000 mg/day for people with HTN and nephropathy

Alcohol recommendations, or precautions, apply to the general public; if used in moderation with food -- and diabetes is well controlled -- BG will not be affected; an alcoholic beverage is 12 oz beer, 5 oz wine, 1.5 oz distilled spirits and can be ingested with the regular meal plan; an alcoholic beverage is best substituted as two fat exchanges

Micronutrients (vitamins and minerals) are not necessary when dietary intake is adequate; there is little confirmatory evidence that micronutrient therapy is beneficial; chromium replacement is beneficial for people with chromium deficiency, such as in the case of long-term parenteral nutrition recipients; potassium loss secondary to HTN related medications may warrant potassium replacement

APPENDIX B
THEORETICAL MODEL FOR PREDICTING PHYSICIAN PRACTICE BEHAVIOR



Appendix B. Behavioral Model for Predicting Practice Behavior. A synthesis of the health belief model (Source: Irwin M. Rosenstock, "Historical Origins of the Health Belief Model". In Health Education Monographs, Vol. 2, No. 4, 1974) and the behavioral model of health services use (Source: Ronald M. Andersen, "Revisiting the Behavioral Model and Access to Medical Care: Does it Matter?. In Journal of Health and Social Behavior, Vol. 36 (March), 1995) to predict nutrition practice behavior among prospective physicians.

APPENDIX C
LIST OF CONTRIBUTORS FOR PHASE I

INDIVIDUALS THAT CONTRIBUTED TO PHASE I
INSTRUMENT DEVELOPMENT

Contributor	Title or Specialty
1. Anonymous	Registered & Licensed Dietitian
2. Dr. Mary Ann Burg	Director or Family Medicine & Sociologist
3. Dr. Benjamin Karney	Social Psychologist
4. Dr. Malassanos	Pediatric Endocrinologist
5. Dr. Muir	Pediatric Endocrinologist
6. Dr. Michael Okun	Neurologist
7. Dr. Lynn J. Romrell	Associate Dean, College of Medicine
8. Anonymous	Diabetic Patient
9. Dr. Silverstein	Director of Pediatric Endocrinology
10. Dr. Richard Usatine	Director of Medical Education
11. Dr. Edward W. Wolfe	Methodologist: Measurement & Assessment

APPENDIX D
INSTITUTIONAL REVIEW BOARD APPROVAL FOR PHASES I & II

Institutional Review Board - 01
University of Florida Health Science Center

Protocol # 48-1998

Project Cover Sheet

Project Title: A Survey of the Attitudes Toward Nutrition Education Among Prospective Physicians

Name of Investigator: Jessica A. Schulman Title: Doctoral Candidate
Department: Health Science Education College: Health & Human Performance

Box #: 118210 Telephone #: 392-0583
Fax #: 392-1909 Email Address: mnt@ufl.edu

Department Chair, Dissertation\Thesis Chair: (if applicable) Dr. William Chen, Dr. Barbara Rienzo

IRB Status

Approved and Exempt (research involves the use of a survey and confidentiality is maintained).

Protocol

The protocol that guides this research originated from the principal investigator.

Purpose of the Research and Reason for Exempt Status:

To obtain a better understanding of the nutrition education needs of future physicians by: (1) evaluating perceived adequacy of nutrition education, (2) intentions to practice nutrition therapy, and (3) sense of self-efficacy regarding initiation of medical nutrition therapy. Exempt status is requested because this research involves only the use of a basic questionnaire.

Summary of research procedure:

The questionnaire will be administered to first year and fourth year medical students via Florida College of Medicine's web site for medical students. Students will be asked for voluntary participation during the last month of their spring semester. A cover page will be presented on-line before the start of the questionnaire that describes the nature of the nutrition survey, instructions, and consent for follow-up (refer to survey cover page). Medical students will use their private identification code to access the questionnaire on-line at this secured site. Raw data will be compiled by UF's Office of Medical Education under the supervision of Dr. Lynn Romrell, will be collected by the principal investigator and prepared for analysis. To guarantee that all students have an opportunity to participate, questionnaires will be re-administered on-line two weeks later to non-respondents (refer to section C for confidentiality).

Procedures for Protecting Privacy and Confidentiality

Information obtained is recorded in such a manner that the participant can not be identified by the principal investigator, directly or through identifiers linked to the participant. Participants who refuse to participate in the survey or follow-up study will only have their assigned code (through the college of medicine) number labeled on the questionnaire. The principal investigator does not have access to these codes. This will guarantee that participants' responses are anonymous because there is no personal identifier attached to the completed questionnaire. In addition, the attached cover page that requests consent for release of information will remain blank.

Information obtained from subjects who are willing to participate in the follow-up survey will only have identifiers linked to the attached cover page (refer to enclosure). Volunteers will only print their last name with first initial – on the electronic cover page, and check a box if they are interested in follow up (refer to informed consent). The cover page will be forwarded to the principal investigator. These data and consent forms will be secured in the principal investigator's locked office file for the remainder of the study.

Confidentiality will be maintained during the study and at no time will the questionnaire reveal any direct identifiers to the participants. At the termination of the study, any documents with identifiers that are linked to the subject will be shredded or destroyed promptly and appropriately.

UNIVERSITY OF
FLORIDA

Health Center Institutional Review Board

PO Box 100173
Gainesville, Florida 32610-0173
Tele: (352) 846-1494
Fax: (352) 846-1497

MEMORANDUM

DATE: March 2, 1998

TO: Jessica A. Schulman
Box 118210

FROM: Ammon B. Peck, PhD.
Vice Chairman, IRB-01

SUBJ: EXEMPTION for IRB ~~#48-1998~~

TITLE: EXEMPT: A SURVEY OF THE ATTITUDES TOWARD NUTRITION EDUCATION AMONG PROSPECTIVE PHYSICIANS

Your exemption request has been reviewed by a member of the IRB executive committee and was APPROVED on February 27, 1998. Your project has been assigned an IRB number, which you should refer to in future correspondence. Enclosed is a copy of your exemption request with the IRB approval stamped on it. If this project changes or otherwise requires IRB review and approval, you have the explicit responsibility to pursue IRB review at that time. In approximately one year you will be contacted by the IRB office and asked to provide some follow-up information (e.g. whether your project is still active; whether any changes have been made since you submitted your initial request).

Your exemption was granted under the following checked category of exempt research using human subjects.
[ ] #1 Commonly accepted educational settings involving normal educational practices.

[✓] #2 Educational tests (cognitive, diagnostic, aptitude, achievement), survey or interviews or observing public behavior.

[ ] #3 Research involving the use of educational tests, survey or interview procedures, or observation of public behavior that is not exempt under 2 above, if the subjects are public officials or candidates for public office or a federal statute requires that the confidentiality will be maintained throughout the research and thereafter.

[ ] #4 Collection or study of existing data, documents, records, pathological or diagnostic specimens, if these sources are publicly available or if the information is recorded by the PI in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

[ ] #5 Research and demonstration projects for public benefit.

[ ] #6 Taste and food quality evaluation and consumer acceptance studies.

Thank you for keeping the IRB informed about your research, thereby allowing us to keep accurate files. If the IRB staff can be of any further assistance, please feel free to call.

encl
cc Division of Sponsored Research
IRB file

UNIVERSITY OF
FLORIDA

Health Center Institutional Review Board

PO Box 100173
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MEMORANDUM

DATE: February 16, 1999

TO: Jessica A. Schulman
Box 118210

FROM: Keith R. Peters, MD.
Vice Chairman. IRB-02

SUBJ: Revision of IRB #48-1998

TITLE: EXEMPT: A SURVEY OF THE ATTITUDES TOWARD NUTRITION EDUCATION AMONG PROSPECTIVE PHYSICIANS

On 2/9/99 a member of the IRB Executive Committee reviewed and APPROVED the revisions that you submitted. A copy of your revision letter dated 2/8/99 has been stamped with the date of IRB approval and is enclosed.

Thank you for keeping the IRB informed about your research project, thereby allowing us to keep accurate files. If the IRB staff can be of any further assistance, please feel free to call.

encl: Dated, IRB-approved Revision Letter

cc: IRB file
Rhonda Cooper-DeHoff, PharmD. (Pharmacy)
Sandra Barnawell, (CRC)

INSTITUTIONAL
FEB 0 8 1999
REVIEW BOARD

UNIVERSITY OF FLORIDA

College of Health and Human Performance
Department of Health Science Education

Room 3, FLG
PO Box 118210
Gainesville, FL 32611-8210
Phone: (352) 392-0583
~~Fax: (352) 392-1909~~
E-mail: hse@hhp.ufl.edu

Date: February 8, 1999
To: Dr. Peter Iafrate & Institutional Review Board Members
Re: Protocol # 48-1998
Title: A Survey of the Attitudes Toward Nutrition Education Among Prospective Physicians.
Principal Investigator: Jessica A. Schulman, MPH, RD, LD

Dear Dr. Peter Iafrate,

Thank for reviewing this project in such a timely manner. Per your recommendations, I am enclosing a clean copy of the new version and an old copy of the research procedure for Time 1. The affected page shows additions in underline -- there was nothing to strikeout.

In order to meet my deadline, the questionnaire should be printed by February 20, 1999. I would be grateful if you could review this revision at your earliest convenience.

Please contact me via e-mail at mnt@ufl.edu or via phone at 392-0853 Ext. 254 with the status on the application. I can also receive faxes at 373-5658. Upon project approval, I would like to pick up the forms in person.

Thank you for your consideration.

Sincerely,

J. Schulman

Jessica A. Schulman, MPH, RD, LD
Doctoral Student, Department of Health Science Education
Enclosures (2)

IRB
APPROVED
ON 2/9/1999

UNIVERSITY OF FLORIDA

College of Health and Human Performance
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Room 5, FLG
PO Box 118210
Gainesville, FL 32611-8210
Phone: (352) 392-0583
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Date: September 20, 1999
To: Dr. Peter Iafrate & Institutional Review Board Members
Re: Protocol # 48-1998 - [illegible]
Title: A Survey of the Attitudes Toward Nutrition Education Among Prospective Physicians.
Principal Investigator: Jessica Schulman, MPH, RD, LD/N

Dear Dr. Peter Iafrate,

Thank for reviewing the following modifications to this project. Some of the additions may NOT need your approval. However, I was encouraged to submit them as a way of guaranteeing that I meet the university's guidelines for dissertation research. In turn, I have included all relevant materials in the case that you feel a full review is necessary. For your convenience, submissions that clearly require your approval are noted (*).

(1) * Pg. 4, #6: There will be fewer potential participants (190) due to the reduced size of the incoming class.

(2) * Pg. 8, #15: Now reads, "an electronic mail will be sent to students to invite and remind them to fill out the questionnaire." Refer to attached sample.

(3) * Pg. 12, Part B: To improve access for students that are off-site during their senior year, and improve the validity of the survey, the questionnaire will be administered to medical students via Florida College of Medicine's web site for medical students through the Office of Medical Education. An electronic cover page will be presented before the start of the questionnaire that describes the nature of the nutrition survey, instructions, and consent for follow-up (refer to survey cover page). Medical students will use their private identification code to access the questionnaire on-line. Raw data will be compiled by the Office of Medical Education under the supervision of Dr. Lynn Romrell, and then provided to the principal investigator on disk. To guarantee that all students have an opportunity to participate, questionnaires will be re-administered on-line two weeks later for non-respondents (refer to section C for confidentiality).

(4) * Pg. 12, Part C: Procedures for protecting privacy and confidentiality: Information will continue to be obtained and recorded in such a manner that the participant can not be identified by the principal investigator, directly or through identifiers linked to the participant. Participants who refuse to participate in the survey or follow-up study will only have their code number labeled on the questionnaire. This number is created by the Office of Medical Education and is not related to any confidential identifiers such as a social security number or birth date. The web site will use the best available computer technology to secure the site, and, in turn, only students with a valid identification number will be able to access the questionnaire. In addition, the principal investigator does not have direct access to these codes. This will guarantee that participants' responses are anonymous because there is no personal identifier attached to the completed questionnaire.

IRB
APPROVED
ON 9/24/99 SF

Volunteers will print their last name with first initial on the attached cover page only if they are interested in follow up (refer to informed consent). In addition, they will be asked to check a box that indicates whether or not they would like follow-up. The cover page will be forwarded to the principal investigator and all forms will be secured in the principal investigator's locked office file for the remainder of the study.

(5) * Coverpage: Due to modifications previously described, an updated version is enclosed for review.

(6) * Questionnaire: Minor modifications have been done to improve the reliability and validity of the survey instrument. In addition, three open-ended questions have been added to the questionnaire (the updated instrument is enclosed).

(7) * Expert Panel: To validate the final instrument, an expert panel of five registered dietitians and one endocrinologist will be mailed a form to review the instrument for: (1) difficulty, (2) importance, and (3) formatting or clarity. Experts' evaluations will be anonymous, since no direct identifiers will be requested (refer to the enclosed expert panel evaluation form and instruction cover page). Expert feedback will be secured in the principal investigators locked office for the remainder of the study.

(8) Published Data from the Association of American Medical Colleges (AAMC) Curriculum Directory for years 1991-1999 will be compiled and cited within the context of my dissertation. All data will be cited per APA guidelines. The enclosed figure was created with the data and will be used in my dissertation (please review the enclosed figure to assess the need for IRB approval).

(9) Acknowledgment: Academic faculty and physicians that provided general feedback, while the initial instrument was being constructed, will be acknowledged in my dissertation. Their names, title, and occupation will be listed (please review the sample to assess the need for IRB approval).

In order to meet the deadline for my preliminary dissertation defense, this research requires approval by November 1, 1999. I would be grateful if you could review these changes and additions before this time.

Please contact me via e-mail at mnt@ufl.edu or via phone at 392-0853 Ext. 254 with the status of this application. I can also receive faxes at 373-5658. Upon project approval, I would like to pick up the forms in person.

Thank you for your consideration.

Sincerely,

Jessica A. Schulman, MPH, RD, LD/N
Doctoral Candidate, Department of Health Science Education
Enclosures (//)

APPENDIX E
NOTIFICATION, CONSENT, AND INSTRUCTIONS FOR PARTICIPANTS

Subject: MEMO
Date: Tue, 18 Jan 2000 12:44:14 EST
From:
Organization: College of Medicine
To: med03@college.med.ufl.edu, med00@college.med.ufl.edu
CC: mnt@ufl.edu

MEMORANDUM

TO: Class of 2000 and Class of 2003

FROM: Lynn J. Romrell, Ph.D.
Jessica A. Schulman, Study Coordinator

SUBJECT: Nutrition Questionnaire

In a couple weeks, you will receive an electronic mail request to complete a brief on-line questionnaire. We are sending it to you in an effort to understand prospective physicians' beliefs and educational needs about nutrition.

The survey is being conducted to better inform practitioners, researchers, and educators who can make decisions about nutrition education in advanced health training programs.

We would greatly appreciate your taking the few minutes necessary to complete and return your on-line questionnaire.

Thank you in advance for your help.

Subject: Nutrition Questionnaire
Date: Mon, 31 Jan 2000 12:44:53 EST
From:
Organization: College of Medicine
To: med03@college.med.ufl.edu, med00@college.med.ufl.edu
CC: LYNN.dean.med.hsc.UFL@mail.med.ufl.edu, mnt@ufl.edu

MEMORANDUM

TO: Class of 2000 and Class of 2003

FROM: Lynn J. Romrell, Ph.D.
Jessica A. Schulman, Study Coordinator

SUBJECT: Nutrition Questionnaire

In an effort to understand your beliefs and educational needs about nutrition, we are asking you to complete an on-line evaluation form. We would greatly appreciate your taking the few minutes necessary to share your opinions.

Please respond before: February, 10, 2000.

The questionnaire can be accessed by year, at the following sites:

Fourth (4th) Year Students: http://www.medinfo.ufl.edu/year4/

First (1st) Year Students: http://www.medinfo.ufl.edu/year1/

Thank you in advance for your help!

If you have questions, please contact the study coordinator at mnt@ufl.edu

Subject: Request
Date: Mon, 14 Feb 2000 15:58:16 EST
From:
Organization: College of Medicine
To: med00@college.med.ufl.edu
CC: mnt@ufl.edu, LYNN.dean.med.hsc.UFL@dean.med.ufl.edu

To: Class of 2000
From: Lynn J. Romrell, Ph.D.
Jessica A. Schulman, Study Coordinator

Earlier this month, you received an electronic mail request seeking your opinions about your nutrition training. For those of you that may not have had time to complete it, please do so now. Every opinion matters in this evaluation and, as a result, we will still accept your responses. Please take the few minutes necessary to fill out the linked questionnaire.
http://www.medinfo.ufl.edu/cgi-bin/eval.cgi?dir=nutrit&form=consent2

This study is being conducted so that prospective physicians like you can affect the way that medicine is practiced. In order for information from the study to be representative, it is essential that each person return their questionnaire. We appreciate those of you that have already participated in this important study.

The study coordinator would be happy to answer any questions you may have about this questionnaire.
E-mail: mnt@ufl.edu

Subject: Request
Date: Mon, 14 Feb 2000 16:03:54 EST
From:
Organization: College of Medicine
To: med03@college.med.ufl.edu
CC: LYNN.dean.med.hsc.UFL@dean.med.ufl.edu, mnt@ufl.edu

To: Class of 2003
From: Lynn J. Romrell, Ph.D.
Jessica A. Schulman, Study Coordinator

Earlier this month, you received an electronic mail request seeking your opinions about your nutrition training. For those of you that may not have had time to complete it, please do so now. Every opinion matters in this evaluation and, as a result, we will still accept your responses. Please take the few minutes necessary to fill out the linked questionnaire.
http://www.medinfo.ufl.edu/cgi-bin/eval.cgi?dir=nutrit&form=consent1

This study is being conducted so that prospective physicians like you can affect the way that medicine is practiced. In order for information from the study to be representative, it is essential that each person return their questionnaire. We appreciate those of you that have already participated in this important study.

The study coordinator would be happy to answer any questions you may have about this questionnaire.
E-mail: mnt@ufl.edu

February 1, 2000

Dear Graduating Seniors or First Year Medical Students,

I am asking for your cooperation in taking some time to complete an on-line questionnaire. The purpose is to know what your opinions are so that medical instructors can better meet the educational needs of future physicians.

If you are willing to participate, you will be asked some questions about nutrition education in medical school and your intention to practice nutrition therapy as a physician. The questionnaire will take approximately 5-8 minutes to complete. All information that you provide will help to assess the training needs of prospective physicians, so please answer each question as accurately as possible.

One and two years from now, we would like to ask you similar questions about your experience as a resident. These questions will take less than 5 minutes to complete. If you are willing to participate in this important follow-up study, please sign and print your name on the consent form below. Participation is entirely voluntary.

Thank you in advance,

Jessica A. Schulman, MPH, RD, LD/N
Department of Health Science Education

- ☐ I am willing to complete the attached questionnaire and participate in a follow-up study of nutrition and medical education. The office of medical education has my permission to release my address or phone number to the principal investigator of the study.
- ☐ I am ONLY willing to complete the attached questionnaire.

CONFIDENTIALITY: The University of Florida is responsible for protecting the confidentiality of your records to the extent provided by Law. Any documents with your name, address, phone or social security number will be destroyed at the termination of this study. To guarantee anonymity, the principal investigator will remove this cover page before any information is reviewed. For comments or questions about the survey, contact Jessica Schulman, via e-mail at mnt@ufl.edu, or via telephone at 392-0583 Ext. 254.

APPENDIX F
QUESTIONNAIRE FOR MEDICAL STUDENTS

MEDICAL NUTRITION QUESTIONNAIRE

Please answer the following questions as accurately as possible.

1. Please indicate your age as of Feb. 1st. 2000
SELECT ITEM [Pop-up Menu]:
<20, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, >45

2. Sex [Radio Buttons]: M F

3. Current or Projected Specialty [Text Field]:

4. Undergraduate Major [Text Field]:

The following questions deal with your experience with "nutrition therapy". This refers to the provision of diet related: orders, instructions, counseling, advice, referral or consultation, screening, and assessment.

5. Estimate the percent of ALL patients (Pts) for whom you have provided nutrition therapy over the past 12 months [For Freshman, the words "during your preceptorship are added"]:
SELECT ITEM [Pop-up Menu]:
>1-10%, >11-20%, >21-30%, >31-40%, >41-50%, >51-60%, >61-70%, >71-80%, >81-90%, >91-100%

6. Estimate the percent of DIABETIC Pts for whom you have provided nutrition therapy over the past 12 months [For freshman, the words "during your preceptorship are added"]:
SELECT ITEM [Pop-up Menu]:
>1-10%, >11-20%, >21-30%, >31-40%, >41-50%, >51-60%, >61-70%, >71-80%, >81-90%, >91-100%

7. Estimate the percent of ALL Pts for whom you intend to provide nutrition therapy to over the next 12 months:
SELECT ITEM [Pop-up Menu]:
>1-10%, >11-20%, >21-30%, >31-40%, >41-50%, >51-60%, >61-70%, >71-80%, >81-90%, >91-100%

8. Estimate the percent of DIABETIC Pts for whom you intend to provide nutrition therapy to over the next 12 months:
SELECT ITEM [Pop-up Menu]:
>1-10%, >11-20%, >21-30%, >31-40%, >41-50%, >51-60%, >61-70%, >71-80%, >81-90%, >91-100%

The following questions seek your beliefs about nutrition. Please select the response that is most accurate.

9. I believe that time devoted to nutrition education in medical school is [Radio Buttons]:
Excessive Appropriate Inadequate

10. Choose the number of separate nutrition courses you have taken in medical school [Radio Buttons]: 0, 1, 2, 3, 4+

11. Choose the number of separate nutrition courses you intend to take before residency [Radio Buttons]: 0, 1, 2, 3, 4+

12. Estimate the total number of HOURS (actual time, not credit hours) you have learned about nutrition as a component of another medical school course, such as biochemistry, or at conferences, rounds, etc.:
SELECT ITEM [Pop-up Menu]:
0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-100, 100-125, 126-150, 151-175, 176-200+

13. Estimate the total number of COURSES that you have taken in medical school that had a nutrition component:
SELECT ITEM [Pop-up Menu]:
0, 1, 2, 3, 4, 5, 6+

14. Choose the total number of separate nutrition courses you took during undergraduate, post-baccalaureate, and graduate years [Radio Buttons]:
0, 1, 2, 3, 4+

15. Estimate the total number of academic, or continuing education, hours you learned about nutrition PRIOR to entering medical school:
SELECT ITEM [Pop-up Menu]:
0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-100, 100-125, 126-150, 151-175, 176-200+

On the scale, choose the extent to which you disagree or agree with the following statement:

16. Nutrition has an important role in preventing health problems [Radio Buttons]:
Strongly Disagree Disagree Neutral Agree Strongly Agree

17. Nutrition therapy is an essential component of successful type 2 diabetes management:
Strongly Disagree Disagree Neutral Agree Strongly Agree

18. Nutrition will have an increasingly important role in disease prevention & treatment:
Strongly Disagree Disagree Neutral Agree Strongly Agree

19. There is a need to support nutrition-related research:
Strongly Disagree Disagree Neutral Agree Strongly Agree

20. Physicians should spend more time exploring the dietary habits of their Pts:
Strongly Disagree Disagree Neutral Agree Strongly Agree

21. Nutrition counseling is a waste of time because Pts don't change their habits:
Strongly Disagree Disagree Neutral Agree Strongly Agree

22. Nutrition is an essential component of comprehensive health care:
Strongly Disagree Disagree Neutral Agree Strongly Agree

23. Diet has no effect on longevity:
Strongly Disagree Disagree Neutral Agree Strongly Agree

24. Physicians should understand principles of nutrition therapy:
Strongly Disagree Disagree Neutral Agree Strongly Agree

25. Physicians should be able to apply principles of nutrition therapy:
Strongly Disagree Disagree Neutral Agree Strongly Agree

26. Dietitians are an important member of the health care team:
Strongly Disagree Disagree Neutral Agree Strongly Agree

27. Medical schools should place greater emphasis on nutrition education:
Strongly Disagree Disagree Neutral Agree Strongly Agree

28. Medical school has prepared me to practice nutrition therapy
Strongly Disagree Disagree Neutral Agree Strongly Agree

Using the scale, judge the extent to which you are confident in your ability to:

29. Refer Pts to reliable outpatient nutrition services (e.g., dietitians, diabetes educators, support groups, etc.) [Radio Buttons]:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

30. Order a nutritionally adequate diet for a newly admitted hospital Pt with type 2 diabetes:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

31. Consider ethnic, cultural, & religious factors when providing nutrition instruction:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

32. Teach patients with type 2 diabetes how to determine the grams of carbohydrate, protein, & fat in each meal:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

33. Provide nutrition information to Pts on how to achieve a desirable weight:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

34. Use recent nutrition-related research to improve patient care:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

35. Present nutrition-related case studies to colleagues at rounds, seminars, lectures, and other forums:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

36. Enable Pts to change their eating patterns through nutrition counseling:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

37. Recommend specific diet changes based on the Pt's metabolic needs:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

38. Provide nutrition instruction to Pts with newly diagnosed type 2 diabetes:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

39. Determine the number of calories that should come from saturated fat in a diabetic Pt's meal plan:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

40. Identify Pts at risk for malnutrition:

Confidence Very Low	Confidence Low	Confidence Medium	Confidence High	Confidence Very High

The following section asks about your knowledge related to nutrition. Please select the response which is most accurate:

41. Guidelines state that type 2 diabetes may be diagnosed if fasting blood glucose is > 126 mg/dL [Radio Buttons]:

True False Not Certain

42. Monounsaturated fat has fewer calories than saturated fat:

True False Not Certain

43. To control blood glucose in diabetes Pts, simple sugars should be avoided and replaced by complex carbohydrates:

True False Not Certain

44. Ice-cream that is labeled "sugar-free" can increase blood glucose levels:

True False Not Certain

45. For Pt's with type 2 diabetes, less than 10% of their daily calories should come from saturated fats:

True False Not Certain

46. Nutrition goals for type 2 diabetes Pts should include: maintenance of near-normal blood glucose, lipid, & blood pressure levels:

True False Not Certain

47. Weight loss of 10-20 lb can reduce hyperglycemia, triglycerides, & hypertension in Pts with type 2 diabetes:

True False Not Certain

48. For long-term weight loss, 250-500 calories less than the average daily requirement is recommended:
True False Not Certain

49. Use of sucrose (table sugar) as part of a balanced meal plan impairs glucose control in Pts with type 2 diabetes:
True False Not Certain

50. A diet containing 20-35 grams of dietary fiber from a variety of food sources is recommended for most people:
True False Not Certain

51. For Pts with mild to moderate hypertension, less than 2,400 mg of sodium is recommended:
True False Not Certain

52. Diabetes Pts on hemodialysis should restrict their protein intake to about < .6 g of protein per kilogram of body weight:
True False Not Certain

53. Alcohol can be substituted for carbohydrate exchanges or carbohydrate calories:
True False Not Certain

54. For diabetic Pts using insulin, 24 oz of beer or 10 oz of wine can be ingested as part of an appropriate meal plan:
True False Not Certain

55. Glycosylated hemoglobin reflects average glycemic control over the past month:
True False Not Certain

56. Dietary cholesterol should be limited to < 300 mg day for diabetes Pts:
True False Not Certain

57. Vitamin and mineral supplementation is advised for most diabetes Pts:
True False Not Certain

Kindly answer the following questions:

58. What nutrition topics would you like to learn more about? [Text Fields]

59. How did you obtain most of your nutrition knowledge and training?

60. How would you like to receive nutrition training?

61. How will you learn about nutrition therapy after you graduate?

62. Please write any specific or general comments regarding nutrition education in medical school or feedback relevant to this survey:

Type password and ID to submit form [Text Field]:
This form is anonymous; your ID code will be used for authentication purposes.

APPENDIX G
QUESTIONNAIRE FOR EXPERT PANEL: INSTRUCTIONS AND FORMS FOR PHASE II

December 13, 1999

Dear Expert Consultants,

You have been invited to review a nutrition assessment instrument for prospective physicians. If you are willing to volunteer in this expert panel, you will be asked to evaluate affective statements and knowledge questions about nutrition education and nutrition therapy. The evaluation will take approximately 15 minutes to complete. Please answer each question as accurately as possible.

The purpose of this review is to validate a nutrition instrument so that medical educators can better assess the educational needs of future physicians.

If you are willing to participate in this panel, please fill out the enclosed form and send it back to the researcher in the enclosed envelope.

Thank you for your help in advance,

Jessica A. Schulman, MPH, RD, LD/N, PhD Candidate
University of Florida, Department of Health Science Education

Time of day: _____ **Medical Nutrition Questionnaire**

Some questions will ask about "nutrition therapy". This term is defined as the provision of diet related: instructions, counseling, advice, orders, prescriptions, screening, & assessment. Please write any suggestions that you feel would enhance the clarity and/or readability of each question for a new physician.

	Rate how you believe a new physician will respond the following statements:				
	Completely Disagree	Disagree	Partially Disagree/Agree	Agree	Completely Agree
1. Nutrition has an important role in preventing health problems	1	2	3	4	5
2. Nutrition therapy is an essential component of successful type 2 diabetes management	1	2	3	4	5
3. Nutrition will have an increasingly important role in disease prevention & treatment	1	2	3	4	5
4. There is a need to support nutrition-related research	1	2	3	4	5
5. Physicians should spend more time exploring dietary habits of their Pts	1	2	3	4	5
6. Nutrition counseling is a waste of time because Pts don't change their habits	1	2	3	4	5
7. Nutrition is an essential component of comprehensive health care	1	2	3	4	5
8. Diet has no effect on longevity	1	2	3	4	5
9. Physicians should know principles of nutrition therapy and how to apply them	1	2	3	4	5
10. Dietitians are an important member of the health care team	1	2	3	4	5
11. Medical schools should place greater emphasis on nutrition education	1	2	3	4	5
12. Medical school has prepared me to practice nutrition therapy	1	2	3	4	5

	Rate the difficulty level of performing each activity by a new physician:					Determine whether or not the following nutrition activities should be an important aspect of medical practice.		
	Very Difficult	Difficult	Partially Difficult/Easy	Easy	Very Easy			
1. Refer Pts to reliable outpatient nutrition services (e.g., dietitians, diabetes educators, support groups, etc.)	1	2	3	4	5	Yes	Neutral	No
2. Order a nutritionally adequate diet for a Pt with type 2 diabetes that is a new admission	1	2	3	4	5	Yes	Neutral	No
3. Consider ethnic, cultural, & religious factors when providing nutrition instruction	1	2	3	4	5	Yes	Neutral	No
4. Teach type 2 diabetes Pts to determine the grams of carbohydrate, protein, & fat in each meal	1	2	3	4	5	Yes	Neutral	No
5. Provide nutrition information to Pts on how to achieve a desirable weight	1	2	3	4	5	Yes	Neutral	No
6. Use recent nutrition-related research to improve patient care	1	2	3	4	5	Yes	Neutral	No
7. Present nutrition-related case studies to colleagues, at rounds, seminars, lectures etc.	1	2	3	4	5	Yes	Neutral	No
8. Enable Pts to change their eating patterns through nutrition counseling	1	2	3	4	5	Yes	Neutral	No
9. Recommend specific diet changes based on the Pt's metabolic needs	1	2	3	4	5	Yes	Neutral	No
10. Give nutrition instruction to Pts with newly diagnosed type 2 diabetes	1	2	3	4	5	Yes	Neutral	No
11. Determine the number calories that should come from saturated fat in a diabetic Pt's meal plan	1	2	3	4	5	Yes	Neutral	No
12. Identify Pts at risk for malnutrition	1	2	3	4	5	Yes	Neutral	No

	Circle the Correct Answer			Rate the difficulty level of each question for a new physician.					Determine whether the question is an important aspect of medical practice.		
	True	False	Not Sure	Very Difficult	Difficult	Partially Difficult/Easy	Easy	Very Easy			
1. Guidelines state that type 2 diabetes can be diagnosed if fasting blood glucose is > 126 mg/dL.	T	F	??	1	2	3	4	5	Yes	Neutral	No
2. Monounsaturated fat has fewer calories than saturated fat	T	F	??	1	2	3	4	5	Yes	Neutral	No
3. To control blood glucose in diabetes Pts, simple sugars should be avoided & replaced by complex carbohydrates	T	F	??	1	2	3	4	5	Yes	Neutral	No
4. Ice-cream that is labeled "sugar-free" can increase blood glucose levels	T	F	??	1	2	3	4	5	Yes	Neutral	No
5. For Pt's with type 2 diabetes, less than 10% of their daily calories should come from saturated fats	T	F	??	1	2	3	4	5	Yes	Neutral	No
6. Nutrition goals for type 2 diabetes Pts should include: maintenance of near-normal blood glucose, lipid, & blood pressure levels	T	F	??	1	2	3	4	5	Yes	Neutral	No
7. Weight loss of 10-20 lb can reduce hyperglycemia, triglycerides, & hypertension in Pts with type 2 diabetes	T	F	??	1	2	3	4	5	Yes	Neutral	No
8. For long-term weight loss, 250-500 calories less than the average daily requirement is recommended	T	F	??	1	2	3	4	5	Yes	Neutral	No
9. Use of sucrose (table sugar) as part of a balanced meal plan impairs glucose control in Pts with type 2 diabetes	T	F	??	1	2	3	4	5	Yes	Neutral	No
10. A diet containing 20-35 grams of dietary fiber from a variety of food sources is recommended for most people	T	F	??	1	2	3	4	5	Yes	Neutral	No
11. For Pts with mild to moderate hypertension, less than 2,400 mg of sodium is recommended	T	F	??	1	2	3	4	5	Yes	Neutral	No
12. Diabetes Pts on hemodialysis should restrict their protein intake to about < .6 g of protein per kilogram of body weight	T	F	??	1	2	3	4	5	Yes	Neutral	No
13. Alcohol can be substituted for carbohydrate exchanges or carbohydrate calories	T	F	??	1	2	3	4	5	Yes	Neutral	No
14. For diabetic Pts using insulin, 24 oz of beer or 10 oz of wine can be ingested as part of an appropriate meal plan	T	F	??	1	2	3	4	5	Yes	Neutral	No
15. Glycated hemoglobin reflects average glycemic control over the past month	T	F	??	1	2	3	4	5	Yes	Neutral	No
16. Dietary cholesterol should be limited to < 300 mg day for diabetes Pts	T	F	??	1	2	3	4	5	Yes	Neutral	No
17. Vitamin and mineral supplementation is advised for most diabetes Pts	T	F	??	1	2	3	4	5	Yes	Neutral	No

The following open-ended questions will appear at the end of the questionnaire.	Please write any suggestions that you feel would enhance the clarity and/or readability of each question for a new physician.
Are there any areas in nutrition that you would like to learn about? If so, please indicate general areas or topics:	
How did you obtain most of your nutrition knowledge and training?	
How will you learn about nutrition therapy after you graduate?	

Time of day:_____

Thank you for taking the time to complete this questionnaire. Your comments will be used to validate a scale that measures specific aspects of nutrition competency among prospective physicians.

Additional comments are appreciated:

APPENDIX H
MESSICK'S UNIFIED THEORY OF CONSTRUCT VALIDITY

Six Aspects of Construct Validity

Aspect	Description	Strategies	Evidence Needed
Content relevance & representativeness	Boundary of the construct domain to be assessed. Assure that important parts of the construct domain are covered	Job analysis, task analysis, curriculum analysis, & domain theory	• Sample domain using American Diabetes Association guidelines • Appraisal by expert judges • RD panel to evaluate difficulty and importance of each item • Compare medical curricula
Substantive theories, process models, and process engagement	Identify domain processes to be revealed in assessment tasks. Tasks should provide an appropriate sampling of domain processes	Think aloud protocols, correlation patterns among part scores, consistencies in response times	• Common factor analysis • Attitude: correlation patterns • Self-efficacy: correlations patterns & Rasch method to assess reliability & outfit statistics • Knowledge: correlation patterns
Scoring models as reflective of task and domain structure (Structural aspect)	Scoring should be consistent with what is known about relationships inherent in behavioral manifestations of the construct	Interrelationships among scored aspects ("structural fidelity")	• Self-Efficacy: Rasch method to demonstrate how score model reflects domain being used–item characteristic curve
Generalizability & boundaries of score meaning	Score interpretation should not be limited to the sample of assessment tasks–it should be generalizable. Score meaning is limited by the degree of generalizability across time, observers, etc.	Degree of correlation for assessed tasks with other activities that represent the construct, or an aspect of it	• Reliability analyses • Comparision to MCAT scores • AAMC curriculum characteristics
Convergent & discriminant correlations with external variables	Basis for construct validation. Appraise whether empirical relationships between measures are consistent with the intended meaning. Constructs represented should account for an external pattern of correlations (convergence & discrimination)	Criterion measures pertinent to the evaluation to examine correlations. Verify the relevance of relationships between evaluation scores & criterion measures–attest to the utility of scores for applied purposes	• Major variables: compare scores between classes students. Assess predictive validity. • Hypothesized correlations, or intercorrelations, between variables should exist. Assess networks of relationships ($\alpha > .70$)
Consequences as validity evidence (Messick, 1981)	Justify engaging in the intended and unintended consequences of scores interpretation. Short- and long-term social consequences of program evaluation should be presented. Any negative impact on participants should not be a result of test invalidity	Evaluate intended & unintended consequences of interpretation & use. Insure that low scores did not occur because the test missed something relevant to the construct, or that low scores did not occur because the assess-ment contained irrelevant factors	• Explain how the MNQ-D is intended to be used • Address consequences • Examine issues that related to underrepresentation and irrelevance

Appendix H. A Unified Concept of Validity (Source: Samuel Messick, "Evidence and Ethics in the Evaluation of Tests". In Educational Reseracher, Vol. 10, No. 9, 1981) and (Source: Samuel Messick, "Validity of Psychological Assessment: Validation of Inferences from Persons' Responses and Performances as Scientific Inquiry into Score Meaning", In American Psychologist, Vol. 50, No. 9, 1995).

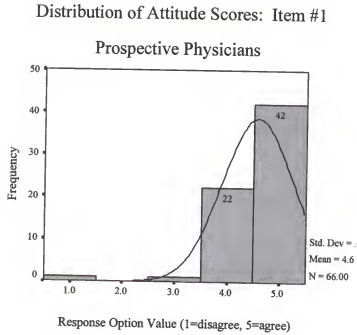
APPENDIX I
DISTRIBUTION OF RESPONSES TO EACH ITEM: NUTRITION ATTITUDES, SELF-EFFICACY, AND KNOWLEDGE AMONG PROSPECTIVE PHYSICIANS

ATTITUDE ITEMS

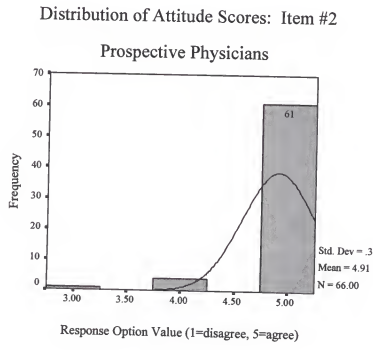
Medical students were asked to judge the extent to which they disagree, or agreed, with the following statements:

Item	Mean
1. Nutrition has an important role in preventing health problems	4.6
2. Nutrition therapy is an essential component of successful type 2 diabetes management	4.9
3. Nutrition will have an increasingly important role in disease prevention & treatment	4.6
4. There is a need to support nutrition-related research	4.4
5. Physicians should spend more time exploring the dietary habits of their Pts	4.1
6. Nutrition counseling is a waste of time because Pts don't change their habits	3.9
7. Nutrition is an essential component of comprehensive health care	4.5
8. Diet has no effect on longevity	4.5
9. Physicians should understand principles of nutrition therapy	4.3
10. Physicians should be able to apply principles of nutrition therapy	4.3
11. Dietitians are an important member of the health care team	4.4
12. Medical schools should place greater emphasis on nutrition education	4.2

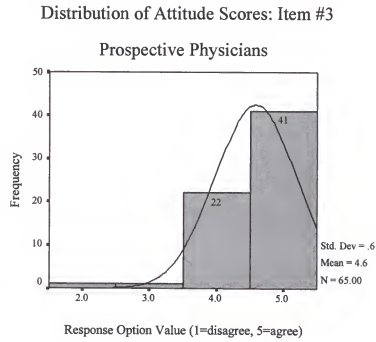
1. Nutrition has an important role in preventing health problems



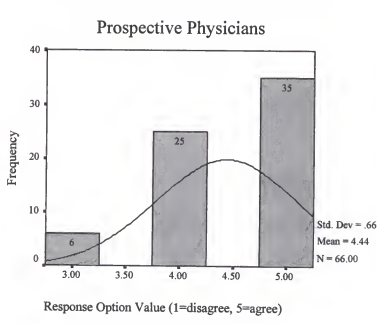
2. Nutrition therapy is an essential component of successful type 2 diabetes management



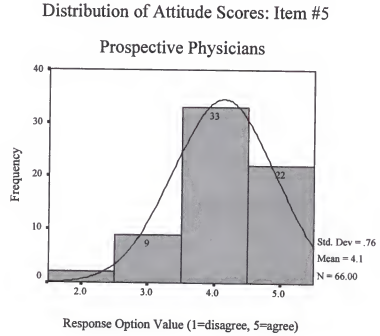
3. Nutrition will have an increasingly important role in disease prevention & treatment



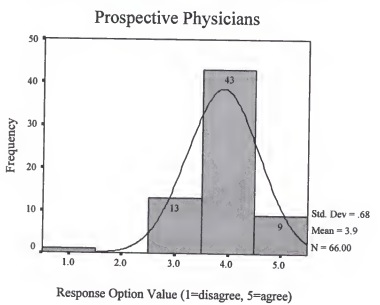
4. There is a need to support nutrition-related research



5. Physicians should spend more time exploring dietary habits of their Pts

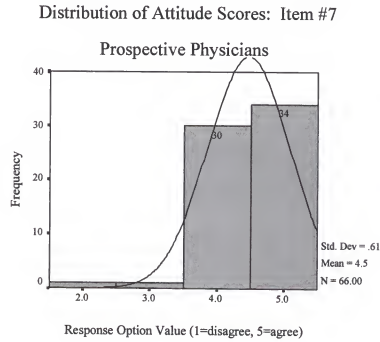


6. Nutrition counseling is not a waste of time because Pts do change their habits

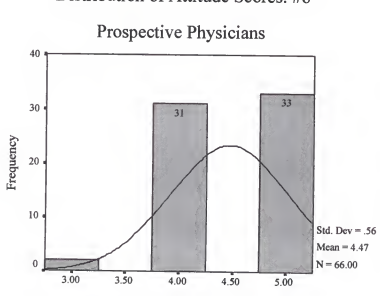


Note: This item was reverse coded. Original statement: "Nutrition counseling is a waste of time because Pts don't change their habits".

7. Nutrition is an essential component of comprehensive health care

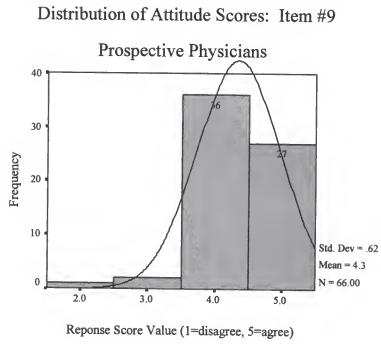


8. Diet has an effect on longevity

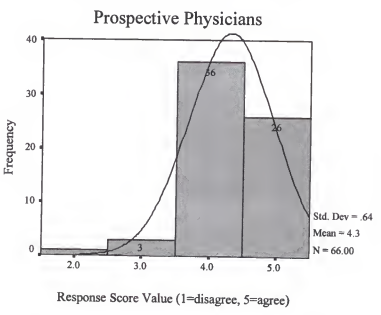


Note: This item was reverse coded. Original statement: "Diet has no effect on longevity".

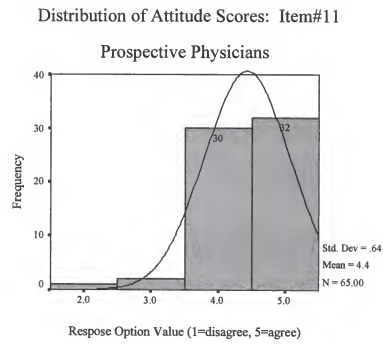
9. Physicians should understand principles of nutrition therapy



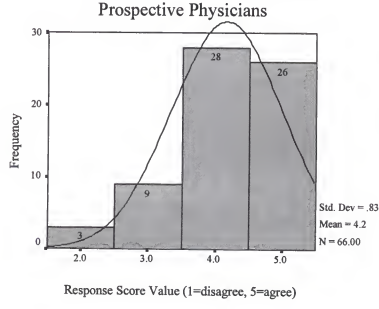
10. Physicians should be able to apply principles of diet therapy



11. Dietitians are an important member of the health care team



12. Medical schools should place greater emphasis on nutrition education



SELF-EFFICACY ITEMS

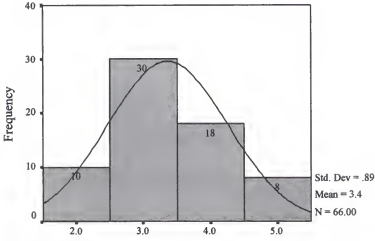
Medical students were asked to judge the extent to which they were confident in their ability to perform specific activities (1=low confidence, 5=high confidence):

Item	Mean
1. Refer Pts to reliable outpatient nutrition services (e.g., dietitians, diabetes educators, support groups, etc.):	3.4
2. Order a nutritionally adequate diet for a newly admitted hospital Pt with type 2 diabetes:	3.1
3. Consider ethnic, cultural, & religious factors when providing nutrition instruction:	2.5
4. Teach patients with type 2 diabetes how to determine the grams of carbohydrate, protein, & fat in each meal:	2.6
5. Provide nutrition information to Pts on how to achieve a desirable weight:	2.9
6. Use recent nutrition-related research to improve patient care:	2.6
7. Present nutrition-related case studies to colleagues at rounds, seminars, lectures, and other forums:	2.1
8. Enable Pts to change their eating patterns through nutrition counseling:	2.8
9. Recommend specific diet changes based on the Pt's metabolic needs:	2.5
10. Provide nutrition instruction to Pts with newly diagnosed type 2 diabetes:	3.0
11. Determine the number of calories that should come from saturated fat in a diabetic Pt's meal plan:	2.2
12. Identify Pts at risk for malnutrition:	3.1

1. Refer Pts to reliable outpatient nutrition services (e.g., dietitians, diabetes educators, support groups, etc.)

Distribution of Self-Efficacy Scores: Item #1

Prospective Physicians

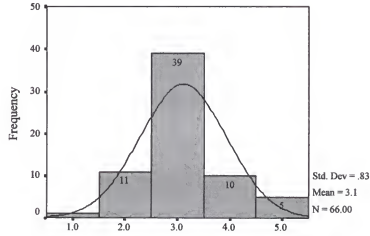


Response Option Value (1=low confidence, 5=high confidence)

2. Order a nutritionally adequate diet for a newly admitted hospital Pt with type 2 diabetes

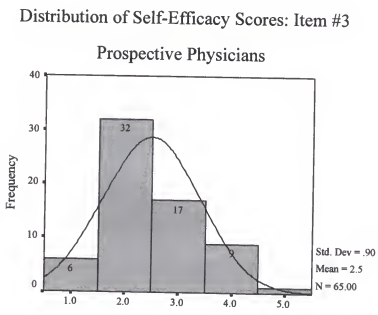
Distribution of Self-Efficacy Scores: Item #2

Prospective Physicians



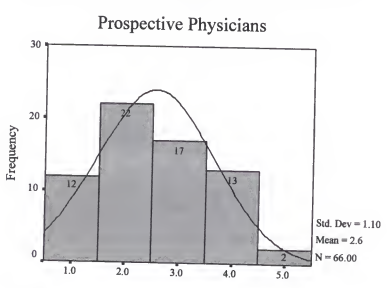
Response Option Value (1=low confidence, 5=high confidence)

3. Consider ethnic, cultural, & religious factors when providing nutrition instruction



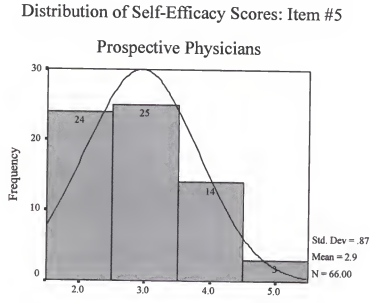
Response Option Value (1=low confidence, 5=high confidence)

4. Teach patients with type 2 diabetes how to determine the grams of carbohydrate, protein, & fat in each meal

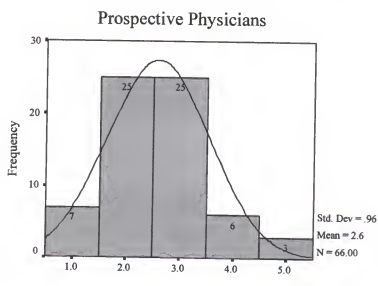


Response Option Value (1=low confidence, 5=high confidence)

5. Provide nutrition information to Pts on how to achieve a desirable weight



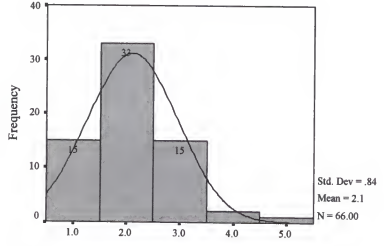
6. Use recent nutrition-related research to improve patient care



7. Present nutrition-related case studies to colleagues at rounds, seminars, lectures, and other forums

Distribution of Self-Efficacy Scores: Item #7

Prospective Physicians

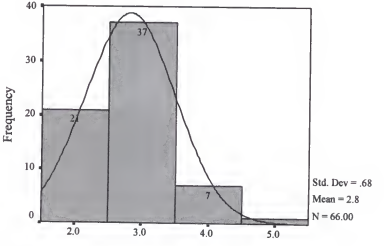


Response Option Value (1=low confidence, 5=high confidence)

8. Enable Pts to change their eating patterns through nutrition counseling

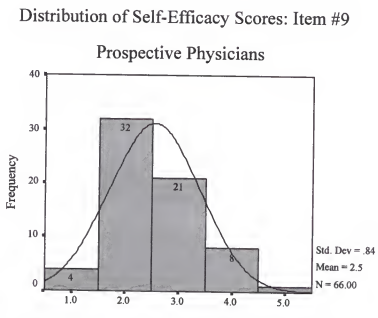
Distribution of Self-Efficacy Scores: Item #8

Prospective Physicians

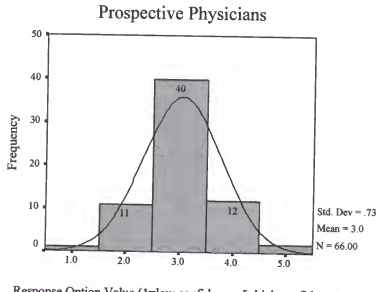


Response Option Value (1=low confidence, 5=high confidence)

9. Recommend specific diet changes based on the Pt's metabolic needs



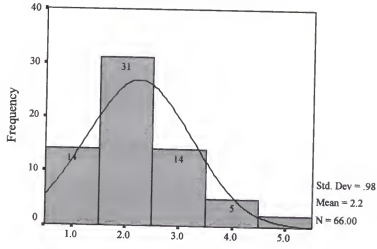
10. Provide nutrition instruction to Pts with newly diagnosed type 2 diabetes



11. Determine the number of calories that should come from saturated fat in a diabetic Pt's meal plan

Distribution of Self-Efficacy Scores: Item #11

Prospective Physicians

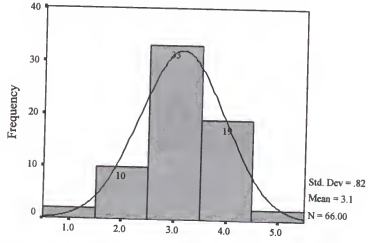


Response Option Value (1=low confidence, 5=high confidence)

12. Identify Pts at risk for malnutrition:

Distribution of Self-Efficacy Scores: Item #12

Prospective Physicians



Response Option Value (1=low confidence, 5=high confidence)

KNOWLEDGE ITEMS

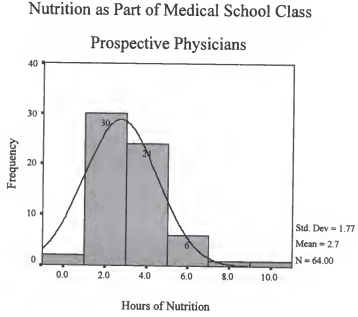
Medical students were asked to select the response (True, False, or Uncertain) which is most accurate

Item	Percent Correct
1. Guidelines state that type 2 diabetes may be diagnosed if fasting blood glucose is > 126 mg/dL:	70.8
2. Monounsaturated fat has fewer calories than saturated fat:	60.6
3. To control blood glucose in diabetes Pts, simple sugars should be avoided and replaced by complex carbohydrates:	16.9
4. Ice-cream that is labeled "sugar-free" can increase blood glucose levels:	64.1
5. For Pt's with type 2 diabetes, less than 10% of their daily calories should come from saturated fats:	33.8
6. Nutrition goals for type 2 diabetes Pts should include: maintenance of near-normal blood glucose, lipid, & blood pressure levels:	89.1
7. Weight loss of 10-20 lb can reduce hyperglycemia, triglycerides, & hypertension in Pts with type 2 diabetes:	97.0
8. For long-term weight loss, 250-500 calories less than the average daily requirement is recommended:	53.8
9. Use of sucrose (table sugar) as part of a balanced meal plan impairs glucose control in Pts with type 2 diabetes:	31.3
10. A diet containing 20-35 grams of dietary fiber from a variety of food sources is recommended for most people:	53.8
11. For Pts with mild to moderate hypertension, less than 2,400 mg of sodium is recommended:	50.8
12. Diabetes Pts on hemodialysis should restrict their protein intake to about < .6 g of protein per kilogram of body weight:	7.7
13. Alcohol can be substituted for carbohydrate exchanges or carbohydrate calories:	55.6
14. For diabetic Pts using insulin, 24 oz of beer or 10 oz of wine can be ingested as part of an appropriate meal plan:	18.5
15. Glycosylated hemoglobin reflects average glycemic control over the past month:	43.8
16. Dietary cholesterol should be limited to < 300 mg day for diabetes Pts:	40.6
17. Vitamin and mineral supplementation is advised for most diabetes Pts:	9.7

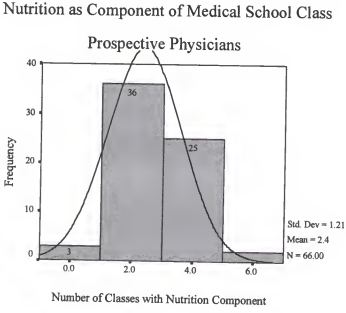
APPENDIX J
DESCRIPTIVE STATISTICS FOR MEDICAL STUDENTS

NUTRITION EDUCATION AS PART OF A MEDICAL SCHOOL CLASS

Fourth year medical students were asked to estimate the total number of HOURS (actual time, not credit hours) that they learned about nutrition as a component of another medical school course, such as biochemistry, or at conferences, rounds, etc.



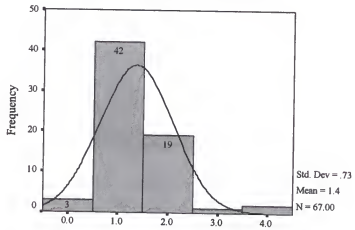
Fourth year medical students were asked to estimate the total number of COURSES that they took in medical school that had a nutrition component:



First year students were asked to estimate the total number of HOURS (actual time, not credit hours) that they learned about nutrition as a component of another medical school course, such as biochemistry, or at conferences, rounds, etc.

Nutrition as Part of a Medical School Class

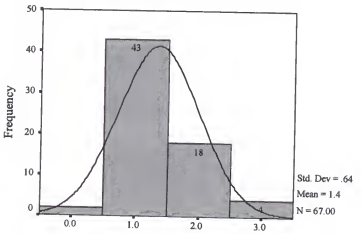
Freshmen Medical Students



Students were asked to estimate the total number of COURSES that they took in medical school that had a nutrition component:

Nutrition as Component of Medical School Class

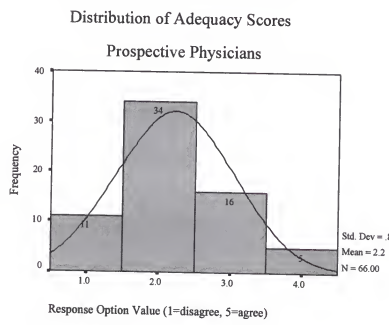
Freshmen Medical Students



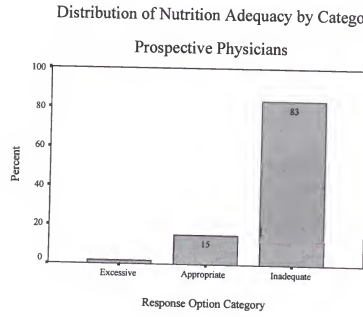
NUTRITION ADEQUACY

Fourth year medical students were asked to rate the extent to which they disagreed or agreed with the following statements:

1. Medical school has prepared me to practice nutrition therapy



2. I believe the time devoted to nutrition education in medical school is:



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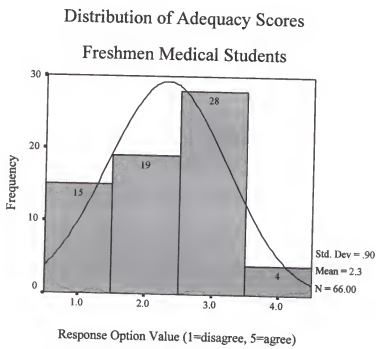

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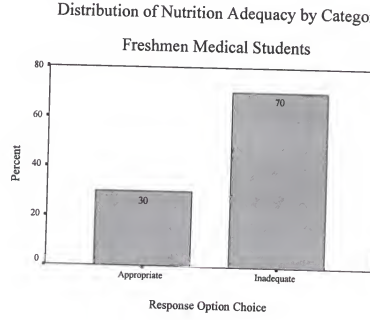
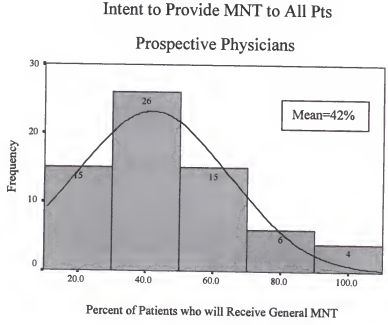
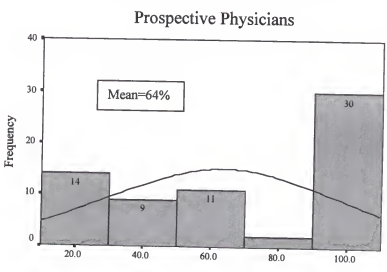


BEHAVIORAL INTENTION

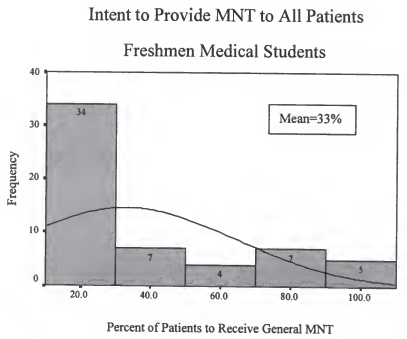
Fourth year medical students were asked to estimate the percent of all patients (Pts) for whom they intend to provide nutrition therapy to over the next 12 months



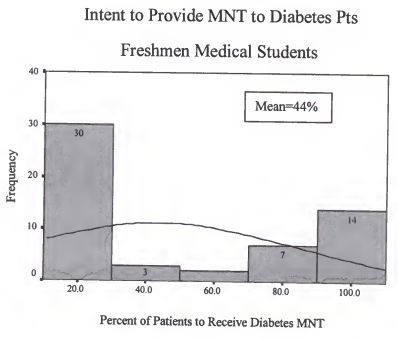
Fourth year medical students were asked to estimate the percent of diabetes patients (Pts) for whom they intend to provide nutrition therapy to over the next 12 months



Fourth year medical students were asked to estimate the percent of all patients (Pts) for whom they intend to provide nutrition therapy to over the next 12 months



Fourth year medical students were asked to estimate the percent of diabetes patients (Pts) for whom they intend to provide nutrition therapy to over the next 12 months



APPENDIX K
QUALITATIVE STATEMENTS FROM PROSPECTIVE PHYSICIANS

MEDICAL STUDENTS WERE ASKED TO ANSWER FIVE OPEN-ENDED QUESTIONS.

1. What nutrition topics would you like to learn more about?

- "real-world" applications
- Diabetic management
- Nutrition for Type I and II diabetics, pts [patients] with hypercholesterolemia or hyperlipidemia, pts with renal failure, pts with liver failure, and pts who are overweight obese.
- Fats and cholesterol - as appropriate components of a balanced diet cultural, influences on diet calorie counting in diabetes, what exactly is an ADA diet? Atkins diet and other current trends that pts follow
- Pediatric nutrition for proper growth and development.
- We could learn a little more about nutrition in the big diseases (diabetes, cholesterol, hypertension, and obesity).
- The nutrition equations
- Vitamins as nutritional supplements and current estimates of appropriate dosages for presumed associated benefits
- Weight loss, diet recs [recommendations] for various disease states including diabetes, heart disease, hypertension
- Diabetes management, in patient- diet plans for various disease processes
- Calculating grams of cho's [carbohydrates], protein, and fat in a meal; rec'ds [recommendations] for diabetics and malnourished patients.
- Appropriate diets for normals vs. certain pts. (diabetics/obese pts./cad [coronary artery disease] pts./etc.) -caloric content of foods; how to count calories; guidelines for normals and pts. -interpreting nutrition info. on food labels
- Latest research and trends
- Diabetic counseling, weight management, appropriate diet for patients at cardiac risk, Omega-3 fatty acids for triglyceride control
- Alterations in nutrition requirements for various disease states. Total parenteral nutrition (how to use, when to use/not use, etc.)
- Just basic general nutrition, especially how it applies to children.
- HAL [hyperalimentation] and TPN [total parenteral nutrition] are big black boxes!!! Very practical information such as how to make meals appealing to picky eaters (every toddler I know) would be very helpful. Just basic facts such as how much protein, fat, carbohydrate, calories etc. are required by healthy and ill people. You can see the deficit of knowledge here! Thank goodness for the Nutritionists in the hospital.
- All of them.
- No
- Proper diet recommendations for different disease processes.
- Vitamin supplementation, nutritious foods, which foods may have a health benefits, organic vegetables, Mediterranean diet, other diets, herbal weight loss regimens, Dean Ornish diet?, benefits of soy and isoflavones, benefit of processed tomatoes and prostate, vitamin E and the heart, does garlic work to reduce cholesterol, do fish oils reduce cholesterol?, red wine/heart disease, anti-oxidants and their role in disease prevention, the

role of folic acid/homocysteine in heart disease,does oatmeal reduce cholesterol, reduce crazy fad diets. How little meat is necessary in our diet. Pediatric nutrition. From the lay press it seems that this long changing diet patterns developed 20, 30, or 40 years ago can only occur when that individual is ready to change. Ketotic diet for pediatric patients with seizures. Glycemic index and foods with lower glycemic index. Food and energy level, etc. Basically all the stuff everybody wants to know but with a scientific basis.

- Total parenteral nutrition and how to order a diet for a patient.
- I would like to learn more about the current research that is going on the nutrition field since, like any scientific field, it is constantly changing. I would also like to receive a recommendation of a reliable and concise source of information so that I can continue to remain current on nutrition recommendations. I think medical students should have training in general nutrition and guidance concerning special diets for diabetic, cardiac, and renal patients.
- Calories as it relates to the type of food and type of disease.
- Nutrition therapy, how to determine patients basal metabolic needs
- Healthy habits and foods Diet and exercise
- 1) How much fat should a normal healthy patient consume? 2) How much sugar/fat should a diabetic patient consume? 3) Which over the counter weight loss supplements are safe and recommended? E.G., dexatrim, slimfast
- If there really is no such thing as the "2000 kcal ADA diet" that we all write for on admission orders, what diet is appropriate to order in the hospital setting for a diabetic pt? appropriate diet for dialysis pts?
- How to estimate amount of carbs, protein, fat in a meal...ie. based on the components and not reading labels
- Topics in which research has shown a benefit in pt health, topics such as Vit C, Vit E, and other such vitamins and minerals
- Specifics on counseling - over and over in lectures, we heard attendings say, "And of course when a patient has condition X you'd need to discuss diet with them", but there would be no specifics on what, "discuss diet", meant. I'd like to know specific recommendations for weight loss, hypercholesterolemia and heart disease, diabetes, hypertension, malnutrition, and pregnancy.
- Current opinion on vitamin supplements. Options/Alternatives to lower cholesterol.
- Dietary guidelines, mostly on an inpatient basis, for diseases like diabetes, heart disease, and renal failure.
- Vitamin supplementation, caloric needs and calculations of fat/carbs etc.
- the facts about carbs, fats, etc.
- Non pharmaceutical weight loss in diabetics and nondiabetics.
- Clinically significant topics, such as nutritional differences in pts such as renal failure, diabetes, etc. All of the nutrition we get in med school is basic science and even that is minimal.
- Specialized diets for diabetics, cardiovascular, weight loss, renal diet, and then general people.
- All the new diets patients are using. Also our dietician at AGH [Shands. Alachua General Hospital] is recommending a high protein low carb low saturated fat but more monounsaturated fat diet which I haven't learned much about.
- Education on diets for diabetics, the renal impaired, coumadin diets.

2. How did you obtain most of your nutrition knowledge and training?

- In conversations with various attendings
- Trial and error, magazines and television, watching other physicians.
- Most of the "published" info I have read has been in the lay press, which is often not subject to peer review (e.g., the 40-30-30 diet). However, a frustrated TPN nurse did give me a crash course one day on the wards so that I could order the proper labs and fill out the TPN form correctly . . .but she just covered in-patient TPN.
- component of medical biochemistry course, pediatric diabetes clinic and Florida Diabetes Camp, word of mouth on wards - pt by pt basis
- From nutritionists in clinic or on the wards and from independent reading.
- Most is hearsay and common sense. No formal training
- Rounds and day-to-day patient care
- From a pool of popular misconceptions
- here and there - no specific courses
- On my own (via concern about my own health).
- Osmosis
- Nurses and nutrition counselors. Personal reading and interest.
- A few noon conferences ("lunch lectures") during Medicine rotation, Inpatient Medicine rounds
- Personal education, attending rounds and education, personal contact with exercise physiologist
- Probably by reading journals
- On the job training by the wonderful nutrition staff and from the nurses and staff in the TPN service.
- On the wards.
- Clinical training and grand rounds
- Personal studying.
- Residents and class work
- School, magazines, & the web.
- Reading on my own. Lectures and rotations.
- Biochemistry classes and on the wards as the subject arose. Most of what I have learned about nutrition has been on my own.
- From different classes, e.g. Biochemistry.
- reading, friends
- Lectures during rotations
- Reading supplements put out by the American Family Physician journal. These are excellent sources of information with regard to this topic.
- Undergrad and on wards
- Class lectures, from others when discussing patients, personal interest
- Upper level residents
- From biochemistry courses
- Fragments of information here and there--some through clinical rounds and dietitians. Also during volunteering at diabetes camp.

- Experience. Asking the nutritionist during third year and being counseled about nutrition personally. Also my own reading in magazines and journals about nutrition.
- Self-learning.
- On certain services like critical care where calculating TPN is used. On "keeping families healthy" course during 4th year. Occasionally on other services like pediatrics, medicine, and surgery. But more complex questions are deferred to the dieticians who were very helpful and knew a lot more.
- clinical experience
- Self-study (and not much of that)!
- Tid bits from rounds, pts, or pharmacists.
- Reading wellness magazines, some biochemistry, and some from the keeping families healthy.
- Keeping families healthy class and from pop literature and Dean Ornishes book.
- Reading

3. How would you like to receive nutrition training?

- Incorporate it more in various courses and include dietetics in clinical years
- Clinical correlations, problem based learning.
- Because the medical school classroom curriculum is so crowded and overwhelming already (and it is sometimes hard to appreciate the relevance of it all), I think nutrition information could be delivered by clinical rotation. For example, TPN management could be delivered to the students on surgical and ICU rotations (most of the surgeon lecturers don't show up anyway); nutrition for diabetics, liver and renal failure during medicine rotations; and nutrition for hypertensives and pts with high lipids/cholesterol during outpt rotations. I know there is an existing elective course on nutrition or TPN, but many students do not appreciate the importance of the topic or, like me, don't have room in their schedule for yet another elective. Therefore, nutrition might be best delivered "prn" - per rotational need.
- Formal setting, allow dietitians to round on wards
- Incorporated into medical school classes when discussing disease management and health promotion
- Scenarios. Have standard diets for people presenting with certain diseases. Make current recommendations more accessible to student in one big packet.
- It would be a very good idea, especially in my chosen field of OB/GYN
- medical school class or symposium clinical rotation in medical school
- Via formal lectures and case studies.
- Structured class/curriculum and shadowing nutritionists in hospital settings and in ambulatory care settings
- Part of curriculum
- Formal lectures from a dietician during Inpatient Medicine Rotation and Outpatient Family Medicine Rotation
- As a formal section within a course in medical school (perhaps part of physiology) as well as a good, solid elective course for 4th year in medical school as opposed to the weak course offered now.

- through a formal class in medical school and lectures in different rotations
- Formally in didactic sessions with consultation available for inpatients as required.
- An on-going semester class.
- Don't like to.
- More interact class work
- From M.D.s and nutritionists. 2 weeks in second year, 2 weeks in 4th year. Provide a handbook we can use on the wards and at home.
- Workshops.
- I think there should be a class in the second year of medical school dedicated to this subject. Also, a small pocket sized handbook for third years would be helpful. The "scut monkey" (Clinicians Pocket Reference by Leonard Gomella) has some nutrition information but is very brief and is geared toward the inpatient setting.
- Yes, maybe one week or even a handout would be helpful.
- course, appropriate lectures during clinical clerkships
- A short lecture series without the stresses of testing
- Nutrition training should make future doctors more aware of their resources. I believe that it is important for doctors to have some handle on nutrition counseling but I think that it is just as important (if not more) for them to know what a nutritionist can do for a patient and also to know when it is appropriate to refer. I would imagine that many doctors do not refer enough for nutrition counseling and that is most likely a factor of not knowing 1)how to refer 2) when referral is appropriate 3)the skills and function of a nutritionist
- Lecturers, shadowing a dietician while counseling patients
- Guide book
- Seems like maybe we need a separate short course that addresses nutrition- it didn't work to gain the knowledge piecemeal from various courses and teachers.
- Seminars--interactive if possible (i.e. actual food portions=carbo exchange) (possible "diet" menus and other options for eating healthy and suggestions on how to get our patients to try it!)
- It would be very helpful to integrate it into the third year, specifically during medicine, surgery and family practice. This is when you are meeting people with diseases that are influenced by diet and would like to learn the latest recommendations. A nutrition consult is very helpful, but you want to be knowledgeable and you want to know what to write in the admission orders when you get to the patient's diet.
- Self-learning and through residency while taking care of diabetics, pregnant women etc.
- Formal classes are okay but the nature of the information is frankly not very interesting. Certain doctors I have run into are very adept at nutrition (like some of the critical care MDs) and they teach by example or on a case-to-case basis, which is excellent.
- A class on nutrition.
- Weekly one-hour classes during some rotation.
- There should be a formal CLINICAL NUTRITION course.
- One course, maybe part of clinical diagnosis, that is taught is by either the undergraduate nutrition people, or people VERY competent in this area.
- I would like to read about more scientific studies published in respected journals.
- Short presentations or discussions

4. How will you learn about nutrition therapy after you graduate?

- In conversations with various attendings
- Journal articles
- From what I've seen so far, it looks like it will be all on my own.
- Independent reading
- I will probably refer to a dietician or learn the basics for the main diseases on my own.
- Hopefully, from taking care of patients and working with a dietician/nutritionist
- Consult a good dietician
- Reading, hopefully guidance from clinical nutritionists and other faculty in residency training
- Conferences? outside reading
- ???
- Osmosis
- Continued self-study
- Noon Conferences
- Part of education as resident in surgery, personal reading and question asking of attendings and colleagues.
- Reading and hopefully lectures
- Residency training will provide some formal education, however, I'm afraid that much knowledge will be picked up piecemeal. Frankly, I've learned more about general nutrition from educating myself to be a good parent than I have learned in Med school.
- On my own, & on the wards.
- Dietitian
- Selected readings
- I will be taking a nutrition class next month, I hope this will give me some direction. Wake Forest has a lot of research going on so I check their web site out from time to time. Find out the main peer review journal articles and go from there.
- From reading on my own and working with patients who require specific needs.
- I will probably get most of my information from clinical dieticians or will look up what I can in textbooks or on the internet.
- As needed, by looking it up in books.
- Journals, books
- I will have to read on the subject or speak with dieticians
- ???
- Research articles, colleagues
- Reading books and articles
- Reading and talking with nutritionists and dieticians
- Through dietitians assisting is patient care. Journal articles, media
- Experience. Being exposed to patients with particular dietary needs and learning from them and the nutritionist.
- Basically informally through my residency years while taking care of patients. I'll try to do some self-directed learning.
- Independent reading and following attendings' guidelines.
- Self study.
- Reading, asking pharmacists and dieticians.

- Self taught
- Reading AAFP or other basic clinical journals. Talking to the dieticians and getting recommendations for articles is another source.
- Reading, CME, dieticians

5. Please write any specific or general comments regarding nutrition education in medical school or feedback relevant to this survey:

- Based on the results of similar surveys, I expect that many respondents will overestimate their knowledge and underestimate the need for curricular changes. Furthermore, most students and physicians are unaware that the US Health and Preventive Services (Healthy People 2010) has issued a goal that all clinicians counsel their patients about physical activity and nutrition, and most medical educators are completely oblivious to the relevance and importance of these topics.
- This is a difficult topic because it takes dieticians many classes and years to learn how to calculate and manage patients. This is a difficult concept to add to a curriculum because most people are scrambling to learn normal and pathology during medical school and preventative care is usually incorporated during residency or if you are a good doctor in the real world.
- It needs to have a greater emphasis
- Nutrition training is currently very poor
- While I believe that nutrition is a very important topic that should be taught to medical students, there are so many important topics to cover in medical school and excessive time should not be spent on nutrition alone. One thing I have come to realize is that nutrition is rather complex and factual. It is difficult to retain these facts. It is probably more beneficial to teach medical students the basics of nutrition and then how to obtain appropriate consultation from skilled nutritionists for more complex issues.
- Definitely need more nutrition training in medical school
- This survey is very well structured. I have heard much discussion over the years about increasing the amount of nutrition education we receive, and we are constantly reminded of its importance. I hope that this study will make that education a reality to future students.
- I wish I felt more confident in my responses to the questions
- It is clear that diet has a major role in vascular disease combined with genetics. Vascular and cerebrovascular disease cause most of the mortality in this country (I think, depending on age groups etc). Delaying these disease processes may give quite a few people a few more years, I hope. I heard the other night that Lipitor is the number one drug on the market and led to the merger of Pfizer and the other company (?Lambert?), 5 billion in sales for lipitor alone, and Japan opens this year. Wow.
- The best way to help doctors place more emphasis on nutrition is to cover it better during the preclinical years and to give students a reliable source to consult later. Best of luck with your survey.
- It is a very broad subject, which takes a long time to master. Everyone knows that nutrition is important, but with today's health care system, a M.D. can not offer to spend

his/her time exploring a pt.'s diet. Although a few questions regarding sodium and fat intake is always appropriate.

- We need to have a basic science course on nutrition
- Our training in nutrition is woefully inadequate. However, as the medical world comes to realize how many different aspects there are to comprehensive care of the patient, I think physicians will also increasingly realize that we cannot run the show for all the dimensions of health- it makes sense to defer to people who specialize in areas like nutrition. We need more knowledge ourselves, but we also need to admit our weaknesses and move to a more collaborative model of health care- and know that if that is what's best for the patient, it's okay if we don't know everything.
- Nutritional information is needed for patient care--however this must be combined with a healthy/active life-style to be overall successful. (i.e. stop smoking and start exercising)
- More nutrition education is necessary. It needs to be taken seriously
- It tough to remember a lot of these numbers because we don't use them that much on a day to day basis - especially in the surgical specialty that I'm going into, we make use of the dieticians/critical care MDs rather than our own information. I would imagine that if I went into a primary care specialty I would not consider my training complete without nutritional training and even some training on herbal/alternative medicines, which are so prevalent.
- Totally inadequate.
- Although we did have some people come in and talk about nutrition, I really don't think it was emphasized nearly enough to enable us to actually use the information in a preventive care setting.
- Not that bad
- We learn basic nutrition but we don't really learn the new trends, which is what patients care about. Many Patients know more about nutrition than docs.
- Nutritional education in medical school centered around the normal individual. This is a good place to start, but it doesn't help you deal with diabetic, dialysis, or hospitalized patients.

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BIOGRAPHICAL SKETCH

Jessica Ann Schulman was born and raised in Los Angeles, California, where she met her husband, Dr. Benjamin R. Karney. After graduating from the University of California, Los Angeles (UCLA) in 1992 with a bachelor's degree in psychology, she went on to achieve a master's degree in public health nutrition from UCLA's School of Public Health. Simultaneously, Jessica completed her dietetic internship at the Veteran's Affairs Medical Center, West Los Angeles and achieved her MPH and certification as a registered dietitian in 1996. During these years, she gained professional experiences working for Dr. Dean Ornish's Preventive Medicine Research Institute, the Women's Intervention Nutrition Study, Cedar-Sinai Medical Center, and the national Women's Health Initiative Study. Throughout her doctoral studies, Jessica taught classes in health and human nutrition, worked as a clinical dietitian at North Florida Regional Medical Center, and earned national honors from professional organizations. In the midst of Jessica's dissertation research her second father, Norman Jack Lebow, suffered a tragic death due to diabetes related complications. Jessica will be continuing her research and plans on developing methods to abridge the gap between nutrition knowledge and practice.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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August 2000

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